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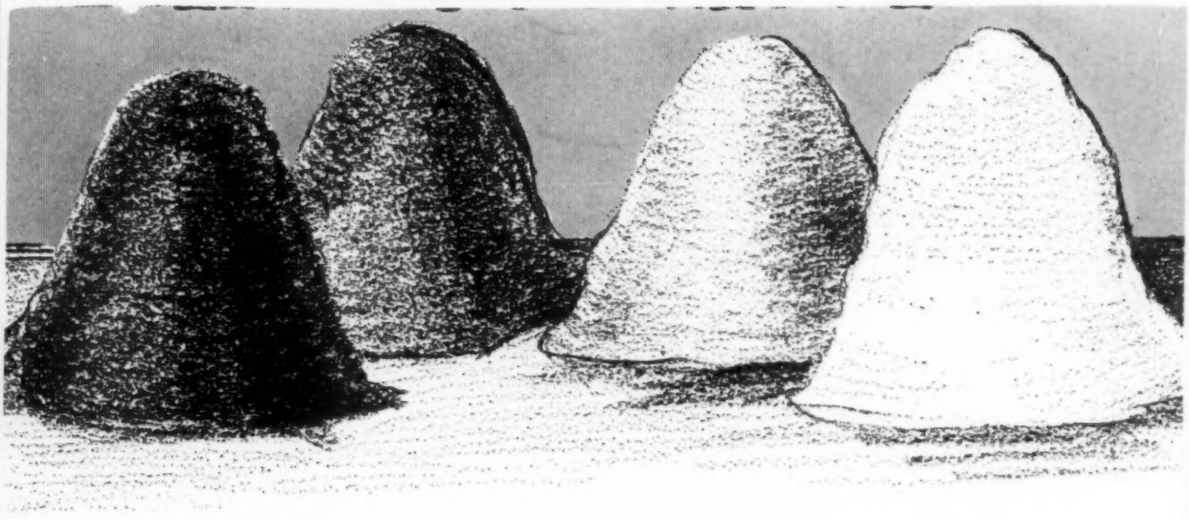

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PLASTICS & MOLDED PRODUCTS

A periodical devoted to the manufacture and use of plastic and composition products

Vol. 4 JANUARY, 1928 No. 1

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PLASTICS

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Vol. 4 JANUARY, 1928 No. 1

Hygroscopicity of Certain Plastics

Accurate determinations of the water absorbtion of casein plastics show that this feature is substantially independent of the method of manufacture

By Otto Manfred and Josef Obrist

of the Physical Institute of the German Technical High School, Brünn, Czechoslovakia

DURING the determination of the water-absorption of two casein solids products of diverse origin that had both been made by the extrusion process, and had been pressed and hardened in the same way, but which had been extruded with different types of headers in the extrusion presses, a great diversity in the water-absorption was noticed.

The samples that were tested, and which originally contained 11.05% and 10.98% of water respectively, had been laid into water. Both samples were in the form of sheets of the same thickness and surface area. The increase in water content, at the expiration of the following periods of time differed widely, as can be seen from the subjoined table No. 1.

	Sample 1	Sample 2
Original water content	11.05%	10.98%
After 49 hours immersion	10.84%	6.64%
93	20.04	11.54
139	29.54	18.71
163	30.89	21.25
211	32.06	23.76
259	32.61	24.91
331	33.16	25.66
383	33.51	26.53
453	33.81	27.02
499	34.02	27.26

Sample No. 1 had its origin in a charge of casein which had been plasticized with the ordinary type of sieveplates such as are described in German Patent 368942 and in U. S. Patent 1,211,526; while sample No. 2 had been made with an arrangement that had some similarities with a dispergator.

Relationship

As the differences between the two samples were entirely too large to be the result of experimental errors, the first inclination was to assume that there was some definite relation between the method of plastification and the hygroscopicity: and this was somewhat analogous to the differences that we discovered and pointed out in an article in the Kolloid Zeitschrift, 1927, 41,438; 42,174; 43,41 on the functional relationship between the elastic and mechanical constant of various artrificial plastic materials and the plastifying work that had been expended on them.

In relation to these mechanical properties we were able to deduce definite conclusions, fully supported by a large amount of numerical data, covering the diverse plastic materials such as the proteinoplastics (albumenoid plastics), synthetic resins (i. e. phenolic condensation products and urea-formaldehyde products), and the direct cellulose plastics such as Celluloid, Cellone, Trolite, vulcanized fiber, paper etc. We found that as the degree of plastification increased the modulus of elasticity would become lower, which is to say that the quality became better, and approached more nearly to that of a standard plastic material, such as hard rubber. The differences in mechanical properties as influenced by the mechanical in-

The present article has reference to the recently published book of Edwin Sutermeister, "Casein and Its Industrial Applications", published by the American Chemical Society, Chemical Catalog Co. New York; and especially to chapter VI, Casein Plastics, by George H. Brother. Mr. Brother, in contrast to a statement of Karl Wernicke (Kunststoffe, 1912, 2, 205) states that the water-absorption of the proteinoplastics is about 18%. As the results published in the present article show, it is evident that Mr. Brother is in error. It remains for a future article, by one of the authors, to answer Mr. Brother and to point out wherein the error lies, and what may have led to the results stated by him.

fluences during manufacture were particularly well marked in the case of the propteinoplastics, where it was possible to use the identical raw materials and yet obtain widely differing products, depending upon the methods used to plasticize the material.

One of the important points that we attempted to illuminate by the work undertaken, was to ascertain the relationship, if any, between the hygroscopicity or water-absorption of various plastic materials and the methods used for plasticizing the material. This point is of extreme importance from an electrotechnical and insulating point of view; and has not been studied in detail before.

Our work first dealt with the casein solids, and as there are at present several distinct methods of manufacturing these products, we will first review these rapidly before entering upon a discussion of the results of our experiments. The general production of the proteinoplastics can be classified into four main groups:

a) The Extrusion process, in which the casein powder, mixed with water and other added materials is mechanically forced through an extrusion press, usually with the aid of heat, being passed through various types of resistances, which may take the form of sieves, dispergators and the like. As contrasted to the other methods in use, this gives the greatest degree of plastification.

b) The rolling process; in which the plastification of the casein is carried out on calendering rolls in a manner similar to the way rubber is worked. The sheets or "pelts" thus produced are then pressed into sheets in hydraulic presses.

c) Block-pressing method. This has some similarity with the previously described methods in that moistened casein is rolled on rolls into a plastic mass which is afterwards consolidated into a block in a hydraulic press; the blocks being subsequently cut into sheets, rods, etc. In this method the degree of plastification is less than in the methods described under items **a** and **b.**

d) Pressing direct from powder. This consists in pressing powdered casein direct under heat and pressure, causing the formation of the plastic body simply by the shear and lateral movement caused by the pressure. This yields the least plasticized material.

The proteinoplastics employed for our experiments on water absorption were represented by as many individual commercial representatives of the above four methods of manufacture as we were able to obtain for this purpose. The following commercial materials, falling into the various groups in accordance with the above classification, were employed:

TABLE II

Method	No.	Product	Shape	Further Description	% Water
Made by Extrusion Processes	1	Galalith I	Plate	Iridscent horn	10.98
	2	Galalith II	"	transparent Buffalo horn	10.51
	3	Galalith III	"	mottled	11.05
	4	Galalith IV	"	blonde transparent	11.34
	5	Galalith V	"	red transparent	11.64
	6	Galalith VI	Rod	inorganic fillers	9.98
	7	Galalith VII	"	inorganic fillers	10.97
	8	Sicalite I	Plate	blonde	11.79
	9	Sicalite II	"	red, coal tar dyed	11.25
	10	Sicalite III	"	Ivory, mineral filler	11.15
	11	Artificial Horn I	"	Horn substitute	11.75
	12	Artificial Horn II	"	mottled	10.98
	13	Artificial Horn III	Rod	Coral	9.97
	14	Erinoid I	Plate	Horn substitute	11.09
	15	Erinoid II	"	Horn substitute	11.26
Rolled	16	Neolith	Plate	Buffalo horn	10.77
Block Pressed	17	Galoid	Plate	Tortoise shell	11.19
	18	Oyogalith	"	Ivory	11.63
Powder Pressed	19	Akalite I	Plate	Horn	10.10
	20	Akalite II	"	Horn	10.35

Extrusion Process.

7 different samples of **Galalith.**
3 different samples of an artificial horn that had been made with an arrangement similar to a dispergator.
2 different samples of **Erinoid.**

Rolling Process.

1 sample of **Neolith.**

Block Process.

1 sample of **Galoid.**
1 sample of **Sicalite.**
1 sample of **Oyogalith.**

Powder Pressing.

2 different samples of **Akalith.**

Two plates, or rods, of each of the above samples, as nearly as possible of the same size and shape, were selected and their original moisture content determined. The results are given in detail in Table No. 2.

Constant Absorption

The results are quite striking. It is plainly evident that casein solids, irrespective of their origin or the method involved in

Fig 1.

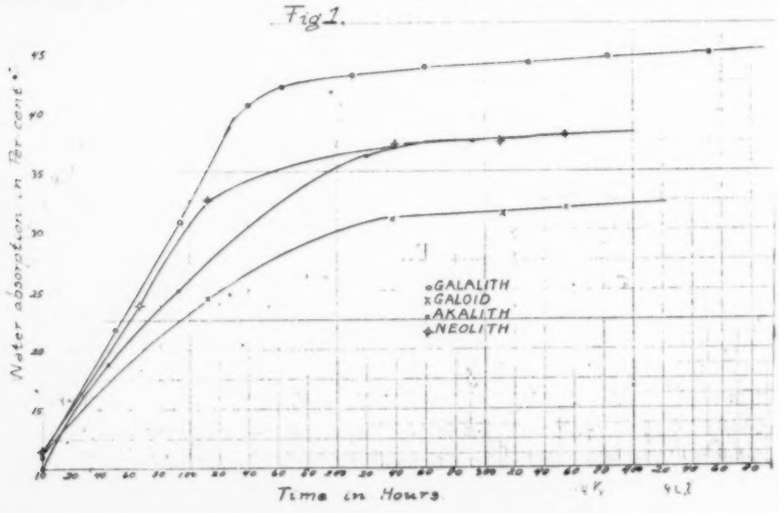


TABLE III
Water Absorption in percent on Samples as in Table II

After Hours	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
44	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7.59	8.71	10.74	.....	.....	8.45	9.32
48	.....	.....	10.84	6.58	8.90	.....	.....	.....	.....	.....	.....	6.64	.....	.....	.....	.....	.....	.....	.....	.....
64	.....	.....	.....	.....	.....	16.28	18.45	24.02	21.99	25.15	.....	.....	.....	.....	.....	.....	13.38	.....	.....	.....
92	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12.91	15.61	22.17	.....	.....	14.15	15.83
93	.....	.....	20.04	12.27	16.68	.....	.....	.....	.....	.....	.....	11.54	.....	.....	.....	.....	.....	.....	.....	.....
96	30.26	30.71	.....	.....	.....	.....	.....	.....	.....	.....	10.58	.....	15.07	.....	.....	.....	.....	.....	.....	.....
112	.....	.....	.....	.....	.....	22.02	25.38	24.95	.....	.....	.....	.....	.....	.....	.....	.....	14.20	.....	.....	.....
139	.....	.....	29.54	21.19	22.95	.....	.....	.....	.....	.....	.....	18.71	.....	.....	.....	.....	.....	.....	.....	.....
144	30.91	26.77	.....	.....	.....	.....	.....	.....	.....	.....	15.16	.....	18.97	.....	.....	.....	.....	.....	.....	.....
163	.....	.....	30.89	24.35	23.88	.....	.....	.....	.....	.....	.....	21.25	.....	.....	.....	.....	.....	.....	.....	.....
211	.....	.....	32.06	26.86	24.71	.....	.....	.....	.....	.....	.....	23.76	.....	.....	.....	.....	.....	.....	.....	.....
218	30.95	30.79	.....	.....	.....	.....	.....	.....	.....	.....	21.84	.....	24.04	.....	.....	.....	.....	.....	.....	.....
221	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	22.03	22.72	27.44	.....	.....	2599	26.64
239	.....	.....	.....	.....	.....	25.51	29.97	25.50	26.18	26.24	.....	.....	.....	.....	.....	.....	19.32	.....	.....	.....
259	.....	.....	32.61	27.48	24.85	.....	.....	.....	.....	.....	24.02	24.91	26.18	.....	.....	.....	.....	.....	.....	.....
292	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	23.33	23.44	27.80	.....	.....	27.55	27.29
312	.....	.....	.....	.....	.....	26.14	30.80	26.19	27.25	26.58	.....	.....	26.79	.....	.....	.....	20.10	.....	.....	.....
331	.....	.....	33.16	27.95	25.39	.....	.....	.....	.....	.....	.....	25.66	.....	.....	.....	.....	.....	.....	.....	.....
334	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	23.72	23.88	28.07	.....	.....	28.01	27.91
354	.....	.....	.....	.....	.....	27.67	31.23	26.42	27.85	27.11	.....	.....	.....	.....	.....	.....	20.35	.....	.....	.....
383	.....	.....	33.51	28.38	25.77	.....	.....	.....	.....	.....	.....	26.53	.....	.....	.....	.....	.....	.....	.....	.....
432	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	28.49	.....	.....	.....	.....	.....	.....	.....
453	.....	.....	33.81	28.84	26.26	.....	.....	.....	.....	.....	.....	27.02	.....	.....	.....	.....	.....	.....	.....	.....
499	.....	.....	34.02	29.12	26.44	.....	.....	.....	.....	.....	.....	27.26	.....	.....	.....	.....	.....	.....	.....	.....
559	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	28.71	.....	.....	.....	.....	.....	.....	.....
632	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	29.34	.....	.....	.....	.....	.....	.....	.....
674	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	29.69	.....	.....	.....	.....	.....	.....	.....
Extrusion Process																Rolled	Block Pressed		Powder Pressed	

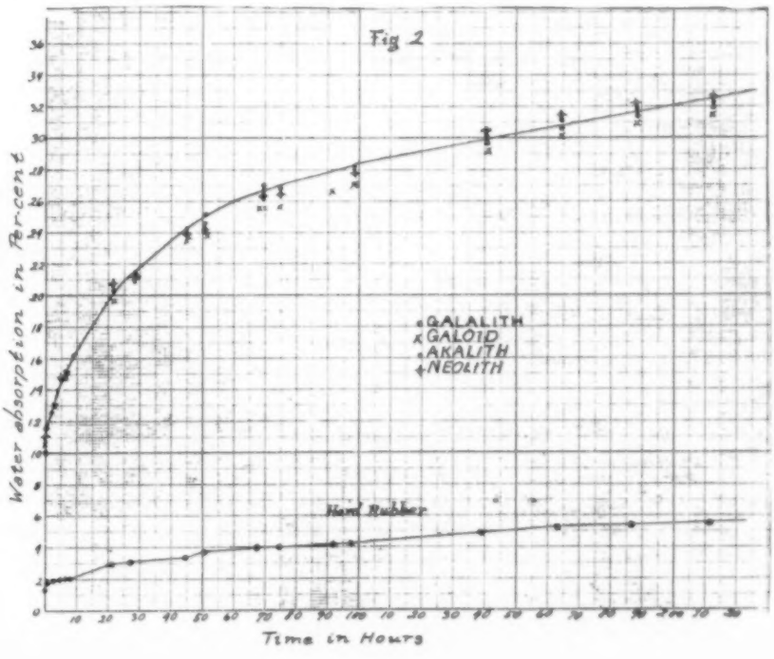
their preparation, when once they have equalized themselves with the conditions of the normal atmosphere, are practically of the same normal moisture content, which lies between 10 and 11%.

The samples were thereupon placed into water at normal room temperatures and the water absorbed ascertained by weighing the carefully wiped plates at intervals of hours. The percentages of water absorbed are given in detail in Table 3.

All Types Alike

A comparison of the figures given in Table 3 shows that there exist no particularly noticeable differences between the various types of casein solids. It is also evident that the water absorption of all the proteinoplastics at first shows a rapid rise, this being superseded by a rather slower but fairly constant increase in water content which, when plotted, gives a gradually straightening or flattening curve. The water absorption of four representative samples, namely Galalith, Galoid, Akalith and Neolith is given in the curve illustrated in figure 1.

The qualitative similarity of the absorption of the water by the various casein solids, and the uniformity of the outlines of the plotted curves made it appear quite probable that the rate of water absorption probably was a function of the condition of the surface of the material undergoing the tests. In order to remove the influence of the surfaces, similar experiments were carried out with samples of the casein solids that had been roughly powdered by means of a rasp. In order to make certain that the results would not be clouded by the presence of fillers and other materials, only such samples



were taken for this test as consisted of pure casein, and which was either uncolored or "blonde" or colored with coal-tar dyes.

Of each type of casein solids tested, and in order to get a fair average sample, six different materials were rasped up into a coarse powder, and two-gram samples of the material were weighed out, and the moisture determined. To do this, the material was weighed to constant weight. The dried rasped samples were then placed in an atmosphere saturated with water-vapor and the percentage increase in weight was determined at certain intervals. As a matter of comparison, a sample of rasped hard rubber was treated as a check on the experiments. The results are given in detail in Table 4.

The results given in Table 4 are illustrated in graphic form in Figure 2, the curves being plotted for the same four samples which were taken for the determination of the data upon which Figure 1 was based. In this case also, the remarkable coincidence of the values obtained shows that the moisture absorption is a fairly constant phenomenon, and the very slight differences in the curves lie well within the limits of experimental error. The behavior of the hard rubber sample is quite interesting. The latter is believed to be quite a definitely defined composition, which is also true of the casein solids tested.

TABLE V
Water Content in Percent

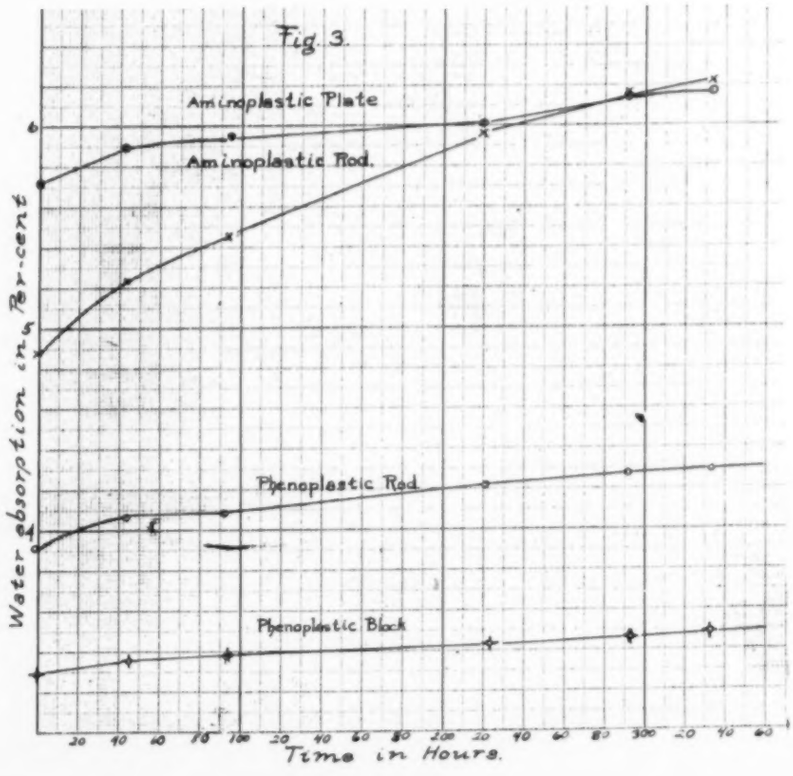
	Phenoplastic Rod	Phenoplastic Plate	Aminoplastic Rod	Aminoplastic Plate
	3.93	3.29	4.88	5.74
After Hours	Water Absorption in Percent			
44	0.13	0.05	0.38	0.15
92	0.16	0.08	0.64	0.21
221	0.29	0.14	1.09	0.32
292	0.34	0.17	1.26	0.41
334	0.35	0.19	1.33	0.43

TABLE IV
Water Content in Percent

	Galalith Plates	Galalith 20 m/m rods	Galalith 5 m/m rods	Artificial Horn Plates	Erinoid Plates	Neolith Plates	Galoid Plates	Oyogalith Plates	Akalite Plates	Hard Rubber Plates
	9.98	11.46	10.43	10.28	10.58	10.77	10.60	11.63	10.28	1.25
After Hours	Water Absorption Percent									
1	1.64	1.97	1.78	1.74	1.97	1.48	1.82	1.52	1.36	0.60
2	2.79	2.71	2.52	2.99	2.88	2.17	2.48	2.08	2.36	0.66
4	3.93	4.00	3.47	3.93	3.95	3.04	3.81	2.86	4.00	0.73
6	4.83	4.69	4.16	4.70	4.58	3.75	4.41	3.59	4.93	0.73
9	6.17	5.81	5.64	5.74	5.42	4.75	5.44	4.89	6.11	0.79
22	10.53	9.21	9.27	9.99	10.37	9.25	9.13	9.18	10.03	1.66
28	11.73	10.47	10.53	11.12	11.76	10.53	10.23	10.35	11.11	1.74
45.5	14.33	13.04	13.07	13.15	14.36	13.18	12.60	12.98	14.00	2.04
51	14.81	13.57	13.53	13.48	14.74	13.64	13.00	13.26	14.94	2.42
68.5	16.42	15.20	15.48	14.81	15.98	15.29	14.52	14.71	16.05	2.60
75.5	16.57	15.72	15.74	14.93	16.08	15.62	15.02	14.85	16.24	2.60
92	17.31	16.33	17.07	16.55	16.73	16.43	15.70	15.48	17.39	2.89

As a matter of comparison, similar experiments to those just described were carried out with two unfilled and merely colored or even uncolored samples of two representative artificial resins, namely two phenoplastics (phenolic condensation products) and two aminoplastics of the Pollak-Ripper Pollopas type (urea-formaldehyde condensation products.) The relative velocity of water absorption of these types of products is infinitely slower than

(*Continued on page 26*)



Electrical Insulation in Germany

Europe rapidly regaining the ground lost in this art during the world war. Recent progress augers well for the production of first class molded products from resinoids.

By Heinrich Prehn

Consulting Engineer; German Correspondent of Plastics

DURING the late European war, and especially in the territory of the literally beseiged Central Powers, the great dearth of raw material, coupled with the almost overwhelming demand for practical and useable insulating materials, both for high voltage and low voltage work, gave rise to a veritable deluge of all kinds and types of substitutes which were denoted as "Insulating Materials." The mere fact that any given material had even feeble agglomerating power and was not a distinct conductor of electricity sufficed to give it a market value.

War Substitutes

Although the materials offered during these trying times were compounded from the right point of view, in that they consisted of binders and fillers, the former were chosen without much regard to the essential properties that are to be expected from a correct type of insulating material. The main purpose to be sought after in preparing an insulating material is to obtain one that has uniform and well characterized electrical mechanical properties.

For example, an insulating material widely offered during the war consisted of nothing more than pitch mixed with fine sand, and was so weak that it would fall to pieces when dropped on the floor. Its electrical resistance was so low that even as weak a current as 250 volts would cause enough current to pass that an appreciable shock would be experienced on placing the hand on the insulation.

Other fairly useful materials, such as hydrocellulose, which had been prepared from viscose, and had already found some application prior to the war, suffered from the great handicap that they were not resistant to moisture. Of course as soon as that occurred, they would begin to conduct the electric current and their disintegration then was very rapid. Other materials, while sufficiently waterproof, had such low melting points that slight rises in temperature would lead to their deformation and even destruction. Among such materials were various waxes and bitumens. Some of these even gave off gases when slightly heated, as by the increase in temperature of the conductors which they were intended to insulate.

IT is rarely that the American reader gets an opportunity to obtain some information as to the progress being realized in countries foreign to the United States in the line of plastic materials.

While it is undoubtedly true that America has made remarkable strides in the electrical insulating industry, the fact remains that European conditions since the termination of the war, almost ten years ago, have given a great impetus to the industries abroad, and the advantages at present held by the United States are gradually being lost.

International trade is bringing American and foreign materials into closer competition on the World Markets, and therefore it is well worth while to keep informed as to what is going on in every civilized country.

The present series of articles, from the able pen of a leading European practitioner in plastic materials will, without doubt, prove valuable and instructive.

Modern Materials

Very fortunately for the German electrical industries, these inferior materials now are only a bad memory. By reason of the great intensity with which German industry is attacking the problem of rehabilitating itself and the remarkable strides that have been made in the few years since the end of hostilities, Germany not only has now caught up to such countries as were not hindered in their development by lack of raw materials, but in some instances has actually overtaken them.

As the industry and technology of the insulating materials in Germany, just before the war, was well developed, and as the progress made in America was watched with great interest, the field of greatest promise was realized as being that of the artificial resins. Bakelite undoubtedly gave the best opportunities for further development.

Pure unfilled artificial resins, especially the pheno-plastics, are only then used for insulation when the article is of an elegant and esthetic nature, and when the question of mere me-

chanical strength is not so very important. Examples of the use of the transparent and pure pheno-plastics may be found in switches for articles of adornment and utility, bell push-buttons, and the like. For all other purposes of electrical insulation the artificial resins are invariably combined with fillers that lend them additional mechanical strength, and also enhance their insulating qualities.

Function of Fillers

The addition of fillers is by no means for the purposes of cheapening the material, as these fillers, when properly selected and employed, materially assist the artificial resin products in the development of increased elasticity, resistance to blows and shocks, and in making them easier to work upon mechanically.

The fillers in use at the present time may be divided into two great groups: inorganic or mineral fillers; and organic fillers, the latter comprising a subclass of fibrous materials. While there is only one mineral fiber, namely asbestos, the organic fibrous materials are of great utility, and practically constitute the only organic fillers widely in use. The most common fillers of this class are wood fiber and wood flour, cellulose, paper, and cotton flock and the like.

Mica

A particularly valuable mineral filler is mica. This has a peculiar laminar structure which when the individual mica plates are cemented together by an artificial resin or by shellac yield an insulating material of remarkable electrical strength. However, such pasted mica plates are somewhat lacking in mechanical resistance and hence they are limited to definite uses in the electrotechnical industries.

However, as a general rule the mineral fillers are not employed nearly as widely as might be supposed. They are used in such cases where the final specific gravity of the material is a matter of indifference and where there is but little need for further mechanical operations following the molding of the articles.

The fundamental principle underlying the manufacture of electrical insulating materials lies in a molding operation. In the case of mineral fillers, this is a comparatively simple matter and it suffices to grind the solid resin together with the mineral fillers in a pebble mill until a uniform finely divided mixture is obtained. This powdered material is then placed in a heated mold, at about 150°C., and after a few minutes of heating and pressing the article can be removed from the molds. In the case of resins that do not become infusible by heat, the mold must be chilled before the molded piece is removed from it.

Cold Molding

However, the production of molded insulation by the cold molding process is even more rapid, but requires a much higher pressure, which in some instances may be as high as from 500 to 1,000 atmospheres. Insulating material having good dielectric properties can thus be made, but the finished articles lack lustre.

On the other hand the molded electrical insulating material that are made with organic fibrous materials possess the advantages of high electrical resistance, ease of working with tools, comparatively low specific gravity and a pleasing appearance. Such materials have achieved a remarkably widespread use. Many of the larger electrotechnical plants have their own molding departments, and numerous large independent custom molding concerns have been established, and are kept very busy.

So far as cellulose and wood fiber and wood flour fillers are concerned, these are employed somewhat similarly to the inorganic fillers, although it is not at all uncommon to effect the incorporation of the resinoid with the binder by means of alcoholic solutions of the former. In that case the wood fiber, etc., is actually impregnated with the resinoid material. The alcohol is recovered by evaporation. The commercial forms of molded electrical insulation for the most part consist of wood fiber and wood flour held together by a resinoid. Examples of such products are dials, sockets, housings, and various panels and mountings employed in the electrical industry.

Electrical Resistance

Qualitatively, the products differ in their properties in accordance to the pressure employed in their manufacture, and in the amount of resinoid used as a binder. For example a molded product containing 80 parts of filler and 20 parts of resinoid, made under a pressure of from 150 to 200 atmospheres is suitable for many applications. In many instances even a smaller percentage of resinoid is sufficient.

The electrical resistance of such pieces is usually of such an order that they will withstand a potential of from 2000 to 3000 volts per millimeter thickness, so that for ordinary electric light and low-voltage motor insulation they are of more than sufficient insulating value. The mechanical properties, especially if the pieces are properly designed to withstand service strains, is also satisfactory. In such cases as where metallic inserts, as screws, are molded into place, it is customary to make the parts where these inserts lie somewhat stronger and thicker.

As far as further mechanical working of the finished pieces is concerned, such as for example the cutting of plates and panels to a given size, the drilling of holes and production of cut threads, this presents no great difficulties, even in case of the cheaper grades of products. Where still greater mechanical strength is concerned, as for instance in the construction of electrical machinery, the molded fibrous insulating materials are

(Continued on page 26)

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were taken for this test as consisted of pure casein, and which was either uncolored or "blonde" or colored with coal-tar dyes.

Of each type of casein solids tested, and in order to get a fair average sample, six different materials were rasped up into a coarse powder, and two-gram samples of the material were weighed out, and the moisture determined. To do this, the material was weighed to constant weight. The dried rasped samples were then placed in an atmosphere saturated with water-vapor and the percentage increase in weight was determined at certain intervals. As a matter of comparison, a sample of rasped hard rubber was treated as a check on the experiments. The results are given in detail in Table 4.

The results given in Table 4 are illustrated in graphic form in Figure 2, the curves being plotted for the same four samples which were taken for the determination of the data upon which Figure 1 was based. In this case also, the remarkable coincidence of the values obtained shows that the moisture absorption is a fairly constant phenomenon, and the very slight differences in the curves lie well within the limits of experimental error. The behavior of the hard rubber sample is quite interesting. The latter is believed to be quite a definitely defined composition, which is also true of the casein solids tested.

TABLE V
Water Content in Percent

	Phenoplastic Rod	Phenoplastic Plate	Aminoplastic Rod	Aminoplastic Plate
	3.93	3.29	4.88	5.74
After Hours	Water Absorption in Percent			
44	0.13	0.05	0.38	0.15
92	0.16	0.08	0.64	0.21
221	0.29	0.14	1.09	0.32
292	0.34	0.17	1.26	0.41
334	0.35	0.19	1.33	0.43

TABLE IV
Water Content in Percent

	Galalith Plates	Galalith 20 m/m rods	Galalith 6 m/m rods	Artificial Horn Plates	Erinoid Plates	Neolith Plates	Galoid Plates	Oyogalith Plates	Akalite Plates	Hard Rubber Plates
	9.98	11.46	10.43	10.28	10.58	10.77	10.60	11.63	10.28	1.25
After Hours	Water Absorption Percent									
1	1.64	1.97	1.78	1.74	1.97	1.48	1.82	1.52	1.36	0.60
2	2.79	2.71	2.52	2.99	2.88	2.17	2.48	2.08	2.36	0.66
4	3.93	4.00	3.47	3.93	3.95	3.04	3.81	2.86	4.00	0.73
6	4.83	4.69	4.16	4.70	4.58	3.75	4.41	3.59	4.93	0.73
9	6.17	5.81	5.64	5.74	5.42	4.75	5.44	4.89	6.11	0.79
22	10.53	9.21	9.27	9.99	10.37	9.25	9.13	9.18	10.03	1.66
28	11.73	10.47	10.53	11.12	11.76	10.53	10.23	10.35	11.11	1.74
45.5	14.33	13.04	13.07	13.15	14.36	13.18	12.60	12.98	14.00	2.04
51	14.81	13.57	13.53	13.48	14.74	13.64	13.00	13.26	14.94	2.42
68.5	16.42	15.20	15.48	14.81	15.98	15.29	14.52	14.71	16.05	2.60
75.5	16.57	15.72	15.74	14.93	16.08	15.62	15.02	14.85	16.24	2.60
92	17.31	16.33	17.07	16.55	16.73	16.43	15.70	15.48	17.39	2.89

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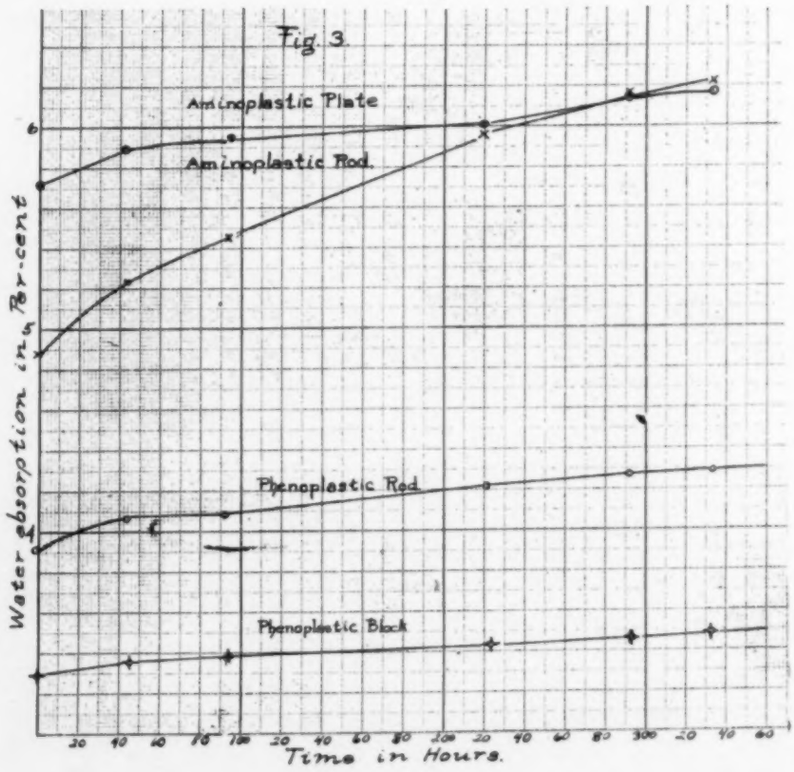

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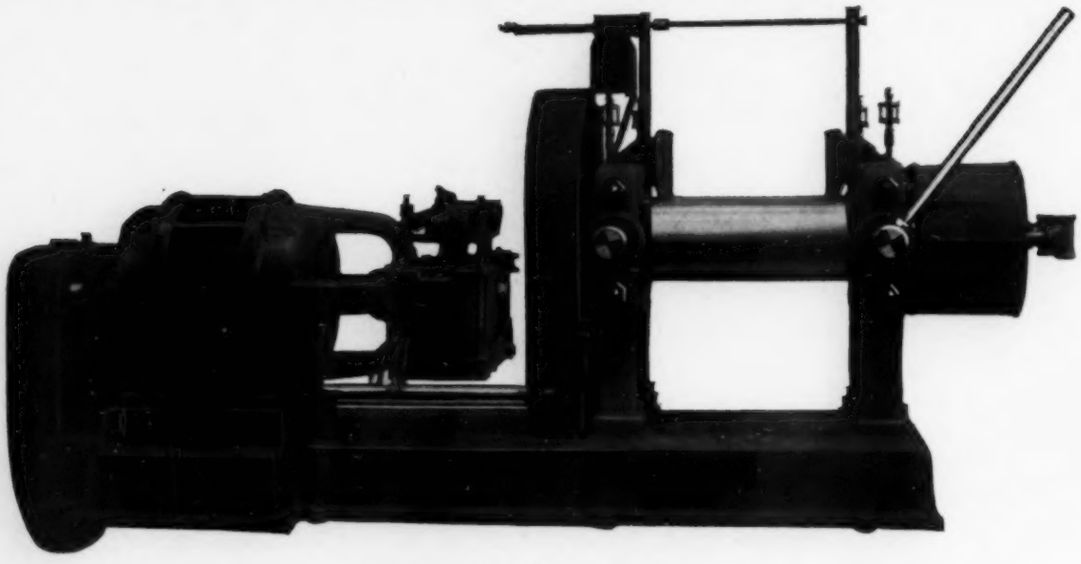

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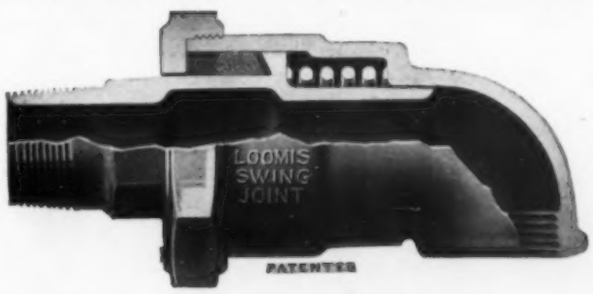

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Laminated Thin Sound Records

The increasing use of huge electrical amplifiers makes the phonograph record of new importance. Saving in space, and minimized breakage, make thin flexible records a valuable addition to the art of molding sound-waves into permanent form.

The orthodox type of disc sound record usually consists of a uniform mass of plastic material that has been molded under heat and pressure from matrices which contain the negatives of the sound waves. The process has been described in detail in *Plastics*, 1926, p. 121, in connection with the plant of the Victor Talking Machine Co.

Laminated records, that is records in which the center consists of a material structurally and chemically different from the outside, have also been proposed in the past, but a recently patented method of Frederick John Turner and John Edward Ernest Starck, of England, has a number of interesting features.

According to their U. S. P. 1,614,413; Jan. 11, 1927, they discuss the problems involved, and their methods of solving them, as follows:

The Old Art

It has been proposed to form records of the laminated type consisting of a record surface material of shellac composition coated or dusted on to a sheet of hard paper which was placed face downwards on a heated matrix and a body portion formed of a plurality sheets of paper alternating with layers of plastic composition placed on the back of the record surface sheet, the body sheets being prepared in substantially the same manner as the record surface sheet, using a cheap or inferior composition instead of the expensive shellac composition. The several prepared sheets were then united by heat and pressure.

The object of the present invention is to provide a durable record which, while capable of manufacture at a low cost, possesses an improved sound-recording surface which renders reproduction of the recorded matter more faithfully, with better tone and with the accompaniment of less extraneous noise or scratching sound.

A striking perspective view of the immense record molding room of the Victor Talking Machine Co. at Camden, New Jersey.

In order to secure the desired results it has been found necessary to employ a record surface material in performed thin sheet form having the qualities and mechanical or physical characteristics exemplified by a non-inflammable and non-resinous cellulosic material, such as cellulose acetate, which may be heated to relatively high temperature without risk of material chemical change.

The adhesive or binding material employed in producing a record according to the invention may be the same in basis as that of the record surface in an appropriate state for the purpose in view, or such may be of a different or cheaper material providing such possesses substantially similar mechanical or physical characteristics.

The material employed is used as an adhesive or binder as distinct from a filling agent or material intended to increase or form a substantial part of the thickness of the record.

In carrying the invention into effect according to one convenient mode by way of example, paper pulp, hygroscopic but substantially free from extraneous or bituminous matter, is made in wet or sheet form such being

(*Contnued on page 31*)

The World Trade in Plastics

II. Czechoslovakia

Industrial conditions in the new Central European Republic and their relation to the industries dealingwith plastic materials

THIS is the second of a contemplated series of articles on World trade in Plastics, based on reports compiled by the Chemical Division of the Bureau of Foreign and Domestic Commerce, through the instrumentality of its foreign representatives. Publication is possible through the courtesy of Divisional Chief C. C. Concannon. This month's survey covers Czechoslovakia's trade in plastic materials and was made by Mr. James F. Hodgson, Commercial Attache.

THERE is no domestic manufacture of pyroxylin plastics in Czechoslovakia. Synthetic resin and casein plastics, however, are produced. Fifty per cent of this is consumed locally. Synthetic resin is manufactured by two firms. One organization is producing it by the action of formaldehyde upon phenol employing a substitute for ammonia as catalyst which it is careful not to divulge. By recent improvements, its imitation amber is alleged to meet every test of the genuine material. At present it is producing between 150 and 200 metric tons of synthetic resin per annum, but it has an annual capacity of 400 metric tons. Its product is sold under the trade name "Solith", registered with the Czechoslovak Government. Applications for registration have been filed in this and all other countries.

Resinoids

The other is producing a synthetic resin which it sells under the trade name "Kabelit." Details of its production and process are not obtainable, but the company is not considered an important factor in the industry.

Synthetic resin is consumed locally in the manufacture of cigarette holders, pipes, umbrella handles, beads, novelties and for insulating material. The latter's use in the local market is limited when compared with other countries owing to the large porcelain industry which produces many competitive articles at lower prices than those made from synthetic resin.

Czechoslovak synthetic resin is exported to other European countries and South America. It is usually sold in blocks, but sometimes in the form of sheets and rods.

Casein plastics are made by two Czechoslovak manufacturers. Each is producing approximately 200 metric tons annually, although their capacity is reported to be considerably larger. The products are known as "Glorit" and "Argolit." Czechoslovak casein plastics are sold only in sheets and rods. They are used in the domestic manufacture of combs, buttons, piano keys, canes and umbrella handles, and similar articles.

Credit and Trade

Credit terms vary according to the standing of the firms. In some instances cash is demanded with the order while in others as high as 120 days open account is allowed. For the Czechoslovakia trade, plastics are customarily packed in 100 kilos wooden cases with metal strapping added if the goods are to be shipped any distance.

The Czech export trade is handled through manufacturers' agents, located in the countries where the goods are sold. None of the local firms are sufficiently large to maintain their own foreign sales organization. The local firms using foreign-made plastics are accustomed to deal direct with the manufacturers. As a result no Czechoslovak business houses are engaged in the importation and distribution of such goods. Therefore, the securing of competent representation presents the greatest difficulty in the distribution of American plastics.

The Czechoslovak import duty on plastics is as follows: Pyroxylin plastic in sheets, rods and tubes, polished, but not worked up .....Free
Other, not specially named artificial turning and carving material, not worked up—50 crowns per 100 kilos.

A considerable quantity of plastics is imported. Most important of these are "Akalit," which is manufactured in Austria; Galalith and Juvelith which are produced in Germany, and "Erinoid", which is of British origin.

The following tables give the Czechoslovak trade for the last few years in "pyroxylin plastic and artificial materials for turning and carving."

	Imports	
	Metric Tons	Value $
1924	894	967,800
1925	1,341	1,295,490
1926*	511	484,890
	Exports	
	Metric Tons	Value $
1924	115	$24,570
1925	257	119,130
1926*	134	59,580

*First 5 months only.

Fabricators in this country are producing practically every article in which plastics may be utilized. The great majority of the factories are located in Bohemia, with many of them con-

(*Continued on page 30*)

EDITORIAL . IMPRESSIONS

Expectations in the Plastics Industries

THERE are two outstanding facts in the development of industries that make for large use of plastics materials. They are the electrical industry, and the motor car industry. Both have shown a truly remarkable growth in the past few years, and, as far as present indications are concerned, the outlook for 1928 is very encouraging; at least as far as the consumption of plastic materials and the production of molded products is concerned.

In Radio

The advent of the commercially successful alternating-current-operated radio receiver gives rise to a large demand for molded tube bases as well as the new upper insulating attachments through which the alternating current is passed to the internal heater-elements of the A-C tubes of a certain type. Many receivers have the rectifying systems built directly into the cabinets, and the condensers, tube-mountings and other fittings are all required to be made of insulating material having high mechanical as well as dielectric strength.

It has been estimated that there is a potential market for these new A-C sets almost equal to the original market for the older style of receivers a few years ago, as many of the owners of battery-operated sets are good prospects for the "direct-from-the-lighting-socket" receivers of the present session. For these reasons, there should be an active demand for molded parts on the part of the producers of radio-set parts.

Automotive

In the motor car field, the indications are for a tremendous expansion, fostered in part by what appears to have all the earmarks of a desperate price-war. While this may not redound to the ultimate benefit of the motor car manufacturers, it will nevertheless increase the number of cars built and sold. There are more molded parts on the modern motor car than ever before. in the history of this industry.

The low priced car

Ford, in his new models, incorporates not only molded laminated resinoid gears, but his high-tension distributer and other electrical ignition parts are of molded resinoid material. Many of the automatic windshield wipers, mirror fitting, etc. are now also of molded material; and the door handles on the closed cars in most cases contain plates of pyroxylin plastics. The use of triplex glass, which contains a central layer of a sheet of cellulose ester such as pyroxylin plastic has already been mentioned last month. As undoubtedly many of the other motor car manufacturers will follow suit, the use of pyroxylin plastic for this purpose should provide an excellent outlet for sheets of this material.

In general

In the hardware field the use of molded escutcheon plates, door knobs, key-hole plates is increasing by leaps and bounds. In the electrical lighting field the employment of entire molded fixtures is becoming common, and a demand for these products is on the increase.

A further industry that is going to consume large amounts of plastic materials, especially in the casein and pyroxylin fields, is that of writing implements, such as fountain pens and mechanical pencils. Cigar-lighters, with molded cases that are impervious to the lighting fluids, and rustless, also furnish an excellent outlet for the molders. In fact, a casual inspection of the gift-ware departments of the larger stores shows a very surprising number of molded gift-articles that were, only a few years ago, made of metal, either cast or spun.

The general public is becoming used to seeing molded desk sets, trays, and even table-ware, and in appreciation of the durability and non-tarnishing properties of these products is making itself felt in an increased demand and more ready saleability of the articles.

A banner year

The general commercial outlook is decidedly encouraging, and if the plastics industry does not have a banner year, it would be most surprising. Only a decided slump in general business could possibly affect the realization of the success in sight. If the producers and molders will cooperate to keep the possible consumer advised of the merits of molded products in place of the countless machined and otherwise fabricated parts, the industry is bound to make even greater strides than it did in 1927.

It was to promote the general and industrial use of the molded component that MOLDED PRODUCTS was inaugurated and in pursuing this aim, the least to be expected is the wholehearted cooperation of all the interested parties, molders as well as manufacturers of plastic materials and molding compounds. With this assured, propaganda, effective and widely distributed, should bring increased prosperity.

PLASTICS

German Celluloid Trade

According to a statement in the German trade journal "Die Celluloid Industrie," the German trade in pyroxylin products leaves very much to be desired.

The Fall Fair at Leipzig, which is usually very well attended by all industrials and manufacturers was virtually deserted, especially as far as the celluloid industries were concerned. After the first two days the booths of the exhibitors were only visited by other exhibitors and people who merely came to shop, but not to buy. The total number of exhibitors also was lower than usual, and only such manufacturers of the raw sheets and tubes exhibited as also had finished fabricated goods to offer.

Conditions Unfavorable

At present the celluloid industry in Germany is in a bad way. Other countries such as Czecho-Slovakia, Poland and Austria were well represented as far as prospective buyers were concerned, but very few sales were effected, as the prices offered were too low.

The worst phase, from the German point of view, was the active and strenuous Japanese competition. The oriental goods, while much inferior in quality, were much in demand, and the prices at which they were offered made competition on the part of German manufacturers simply impossible. At least one large German celluloid concern has taken the initiative in fabricating low quality goods, and articles made from thinner material than standard, in an attempt to compete with the Japanese. The consequent ill effects on the other German manufacturers are painfully evident.

Practically no larger orders were placed, and the immediate future of this industry in Germany is evidently none too rosy.

An authoritative article on the Celluloid Industry in Germany is in preparation.

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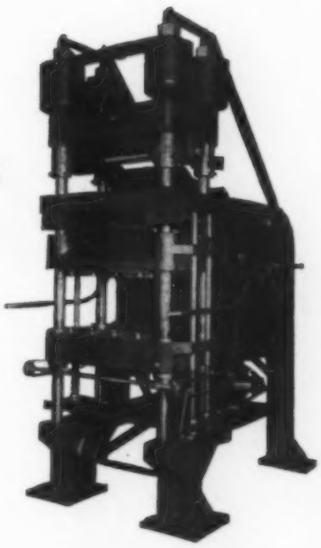

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TECHNICAL ABSTRACTS
AND PATENT REVIEW

Hydraulic Molding Press. Conrad C. Jacobsen, assignor to John Robertson Co., Brooklyn, N. Y. U. S. P. 1,636,962; July 26, 1927.

This invention provides an improved construction of hydraulic presses for molding articles of plastic composition. It is especially designed for articles which are formed in a molding chamber, where it is desirable that the article receive pressure from opposite ends of the molding cavity.

The press is of upright construction, having a stationary hydraulic cylinder suitably supported on frames, and above this a stationary molding member containing the molding cavity. Beneath the molding cavity is a plunger adapted to rise and close the bottom of the cavity, this plunger being mounted on a hydraulic ram the cylinder suitable supported on frames, integrally with the first-named hydraulic cylinder. Above the molding cavity is a molding plunger or mandrel carried on a movable crosshead which is connected by tie-rods or pillars with a crosshead beneath, and the latter carries the ram of the lower hydraulic cylinder. Valves are provided for directing water into either or both the hydraulic cylinders for moving under suitable pressure the respective molding plungers. A pair of hydraulic backing cylinders is provided, having rams suitably connected to the movable member of the press (comprising the connected upper and lower crossheads and the parts moving them), whereby to lift such movable member after each molding operation.

Ophthalmic Mounting. Joseph Shyer, assignor to Zylo Ware Corporation, New York, U. S. P. 1,642,090; Sept. 13, 1927.

A member for an ophthalmic mounting comprising a piece of material having a groove cut therein, a reinforcing wire of approximately equal width but less thickness than the depth of said groove placed against the bottom thereof, and a sealing strip cemented in the said groove filling the latter over said reinforcing wire.

Molded Mica Plate Composition with use of phenol-glycerol resin. Joseph M. Coffey, assignor to Mica Insulator Co., New York. U. S. P. 1,645,415; Oct. 11, 1927.

Mica plates are cemented together and molded under pressure by aid of a condensation product of glycerol and phenol condensed in the presence of very small amounts of sulfuric acid, The reaction being carried out between 160° and 190° C. The resin is a dark rubbery mass quite different from the usual artificial resins.

Comb. Clarence G. Anderson, of Ottumwa, Iowa. U. S. P. 1,642,916; Sept 20, 1927.

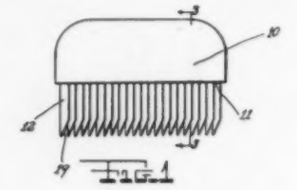


FIG. 1

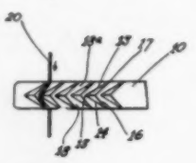


FIG. 2

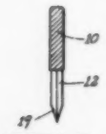


FIG. 3

The main object of this invention is to provide a comb constructed in such manner as to facilitate the curling of hair. In providing combs with straight teeth having parallel spaces between them, the hair is simply retained in straight position in being combed. This invention aims to provide teeth on a comb which are of triangular outline and are off-set from each other in such manner that the edge of one tooth overlaps the edge of the adjacent tooth so that the spaces between the teeth are situated at an angle with respect to the line of travel of the comb in passing thru the hair, thus causing the hair to be bent curled in being combed.

The above and other objects will become apparent in the description below, in which characters of reference refer to like-named parts in the drawing.

Referring briefly to the drawing, Figure 1 is a front elevational view of the comb.

Figure 2 is a bottom plan view of the same, showing the method of bending the hair to form it into a curl.

Figure 3 is a sectional elevational view taken on line 3—3 of Figure 1.

Manufacture of Celluloid Rattles. H. Bahls, Kunststoffe, 1927, **17**, 245.

The manufacture of the common rattle is described and illustrated. The blowing method is said to be the one most in use.

Japanese Celluloid Industry. Paul Bührle. Kunststoffe, 1927, **17**, 249.

This has already appeared in full in our pages, having been taken from the "Celluloid Industry." (See PLASTICS for October, 1927).

Manufacture of Cellulose Acetate with use of Perchlorates as Catalysts. Carl J. Malm, assignor to Eastman Kodak Co., U. S. P. 1,645,915; Oct. 18, 1927.

It was found that the following perchlorates, in the order given, are excellent catalysts in the acetylization of cellulose: aluminum, copper, zinc, ammonium, methylamine, manganese, magnesium, calcium, barium, quinoline, lead and pyridine perchlorates.

Magnesium perchlorate, as more readily controlled and yielding lighter colored products, is preferred. For example, into an acetylating bath consisting of 500 parts by weight of glacial acetic acid, 300 parts of acetic anhydride and 2 parts of magnesium perchlorate, there are introduced 100 parts of cellulose such as cotton, tissue paper, wood pulp or the like; and the acetylization carried on at 40°C. until the cellulose has disappeared. The further treatment, such as hydrolysis to the acetone-soluble stage, and recovery of the product and raw materials in excess then follows standard practice.

New Cellulose Compounds made by acting on Viscose with Mono-halogen fatty acids. Cellulose-xanthate-fatty acids or cellulose-thionthiol-carbon-hydroxy-paraffin-monocarboxylic acids. Leon Lilienfeld, Vienna, Austria. U. S. P. 1,642,588; Sept. 13, 1927.

The new products, which lend themselves to the production of films, artificial filaments, impregnating solutions, coatings, etc., etc. are initially water-soluble but become insoluble on heating. The preparation of the new products is described in detail in our present issue.

Analysis of Plastics Made from Gelatin. A. D. Lutringer, Caoutchouc et Gutta-percha, 1927, **24**, p. 13745.

Various plastic materials are made from glycerol and gelatin, with various inert fillers. Generally, an analysis of such plastics comprises a determination of these ingredients. L. suggests the following procedure:

The plastic is soaked in water for a few hours to soften the gelatin, the excess of water is then poured off, and the plastic melted by heat. The molten mass is then gradually poured into boiling alcohol, in which the gelatin is insoluble and hence will be precipitated, while the glycerol present remains dissolved in the alcohol.

The precipitated gelatin is separated from the alcohol by decantation, dissolved in water and the water then driven off by evaporation on a water-bath, dried at 120°C. and weighed.

Needless to say the mineral fillers are likewise thrown down by the alcohol, and the weight thus obtained is that of the fillers and gelatin combined. The dried and weighed material is then ignited and the ash represents the mineral filler, the difference being the gelatin. The determination of the glycerol in the alcoholic solution follows standard procedure. The author claims the present method is more exact and easier to carry out.

Mold for and Method of Molding Variometers. Clarence D. Tuska, assignor to the C. D. Tuska Co., Hartford, Conn. U. S. P. 1,630,874; May 31 1927.

The object is to mold a variometer in which the coil windings are kept in place on the inside of the molded shell. A mold having a removable core serves as the winding mandrel for the band of coils whereby the holder, which may be of any suitable hardening insulating plastic, may be molded around the coil windings and with sufficient pressure to imbed the windings securely in the inner surface of the holder.

Molding Press. Hubbard N. Nitchie, assignor to the Watson-Stillman Co., New York, N. Y. U. S. P. 1,628,057, May 10, 1927.

The patent covers in great detail the mechanism and operation of an elaborate automatic hydraulic press for the commercial production of molded parts such as radio dials, phonograph records etc. Eight sheets of drawings, 14 pages of text and 41 claims cover the device.

Ester Resin Composition comprising glycerol and phthalic acid. Rapid-curing "glyptal" resin. James G. E. Wright and Willard J. Bartlett, assignor to General Electric Co., Schenectady, N. Y. U. S. P. 1,634,969; July 5, 1927.

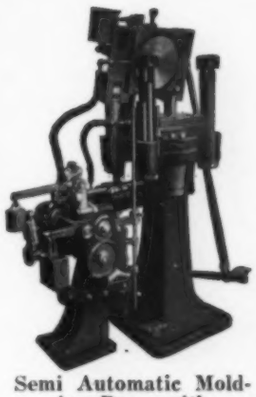
A more rapidly curing type of "glyptal" resin is produced by taking glyptal, which is a glycerol-phthalic acid resin, dissolving it in a high-boiling solvent such as diethyl phthalate or benzyl benzoate and heating the mixture under a reflux condenser to from 210° to 290° C. The changed glyptal resin is precipitated from the reaction mixture by pouring the same into benzol, where the resin will separate as a white curdy mass; which, after, drying is ground into powder. The product is slowly soluble in acetone. The resin is non-corrosive to metals and cures rapidly into the insoluble and infusible stage at 180° C.

KINON. A new "triplex type" of glass. E. O. Rasser, Kunststoffe, 1927, 17, 246.

Evidently glass consisting of three layers, namely glass, celluloid, and glass, are something that is new to our European contemporaries, as they describe the well-known properties of what has come to be known as "Triplex" glass in America. In the case of "Kinon," as the new product is called, the interior layer comprises pyroxylin plastics, instead of cellulose acetate. The Kinon glass is said to be practically burglar proof as well as non-shatterable.

HYDRAULIC PRESSES

For Hot and Cold Molding



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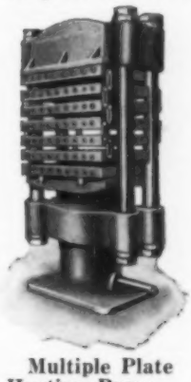
Plain Heating Press

We show here just a few examples from our large line. They are made in standard sizes from 10 to 1,800 tons capacity and the number of plates and size of openings can be made to suit conditions. The top platens can also be made adjustable to accommodate various heights of dies, etc.



Multiple Plate Heating Press

Here is a new press for molding Bakelite, Redmanol, Condensite, Celluloid, etc., in which are incorporated certain features that increase production and decrease mold costs.

1. Hydraulically actuated ejectors top and bottom, are operated independently of the main ram and allow the operator to eject molded pieces at any position of the main ram, thereby saving time.
2. Hydraulic reseating of ejector pins and hydraulic operation of ejectors is positive and dependable, which is not the case with spring weighted ejectors.
3. The ejection stroke of the bottom dies is equal to the stroke of the main ram. This long stroke makes it possible to mold deep pieces and eject them without sacrificing any of the press opening.

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Hygroscopicity of Plastics

(*Continued from page 14*)

that of the proteinoplastics; as is evidenced by the results obtained and given in Table 5, and plotted in graphic form in figure 3.

of this material were of the same origin, but the plate was smooth, while the rod was slightly rough.

The same materials when subjected in plate and rod form

TABLE VI

	Water Content in Percent			
	Phenoplastic Rod	Phenoplastic Plate	Aminoplastic Rod	Aminoplastic Plate
	3.93	3.29	4.88	5.74
After Hours	Water Absorption in Percent			
99	0.03	0.02	0.07	0.07
233	0.05	0.03	0.10	0.11
305	Constant	Constant	0.11	0.13
			Constant	Constant

One of the outstanding facts noticed in this case is the influence of the condition of the surface of the samples tested. This was particularly noticeable in the case of the aminoplastics. Both the rod as well as the plate to an atmosphere saturated with water-vapor showed only a very slight water absorption which in the case of the phenoplastics reached equilibrium after about 230 hours; and in the case of the aminoplastics in about 300

Insulating Materials

(*Continued from page 16*)

not sufficiently strong, and at the present time only products comprising paper are employed for the more severe service.

These paper products are denominated, in Germany, as "Hard papers" (Hartpapiere), having received their name from the time when shellac was exclusively employed for uniting sheets or plates of paper into laminated structures. (In America such products are known as laminated insulation). The usual method of preparation consists in impregnating sheets of paper, or cardboard, with a resinoid, whereupon the sheets are stacked up and united under heat and pressure. By increasing the number of laminations, the mechanical as well as the electrical strength can be greatly increased.

The final strength of these laminated resinoid-impregnated products is a factor of the the strength of the paper sheets used for their manufacture. An especially strong product can be produced by the use of such a strong paper as Swedish soda-process paper (Kraft paper), particularly when the paper is used with the grain running the proper way. Products have been prepared from this material that were very much stronger than any hard wood.

Testing Methods

The Society of German Engineers (Verein deutscher Ingenieure, usually abbreviated V. D. I.) has issued approved testing methods for the evaluation of insulating materials. The German governmental authorities have adopted these tests as standard and have issued a definite classification of the

hours. (See Table, 6, page 26).

Pyroxylin Plastic

A sample of celluloid, which, as we were merely attempting to get some comparative data, was tested in only one sample, behaves very much the same as the aminoplastics. However, equilibrium as regards water absorption in water vapor was reached in a shorter time, namely 100 hours; and the amount absorbed (0.05%) was lower.

Conclusions

The present results are to be interpreted merely as preliminary; and it is evident that even the comparatively crude methods employed point unmistakably to the fact that as far as the absorption of water by plastic materials is concerned, the degree of plastification and the effect of the various manufacturing methods is of very slight, if any, influence.

As to the underlying causes of the water absorption of the various modern plastic materials, the relationship of the physical condition of the same and the influence of temperature, pressure, degree of moisture acting upon the same, and similar points, these will be gone into more deeply in a subsequent article. Work on this problem is now actively under way, and the results will be published as soon as a classification of the data, and an orientation as to its significance can be had.

Brünn. Czechoslovakia Physical Institute of the German Technical High School. 1927.

Electrical Insulation

(*Continued from page 26*)

synthetic electrical insulating materials. Three tests are most in use; the electrical break-down test, the transverse breaking strength test based on impact, and resistance to heat.

The German tests and their method of carrying them out will be discussed in their next article, which will appear in the February issue of PLASTICS.

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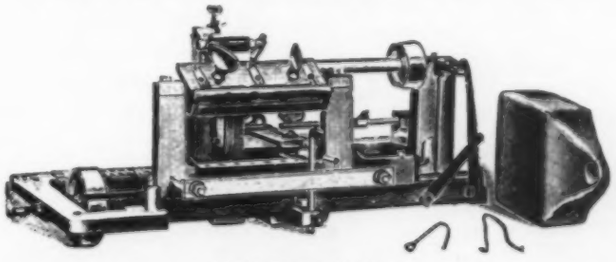

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Wood Flour, the Veritable Backbone of Plastics

By Noel Lequig

THE term "wood flour" implies to the molder of plastics, particularly the phenol resinoid materials, a "filling" substance. The term "filler" is however, unfortunate, inasmuch as wood flour is not added to phenol resinoid for the purpose of contributing to the weight or bulk of finished product. Neither does it represent an attempt to conserve on the amount of resinoid binder used. In phenol resinoid material wood flour has two principal functions: (1) It contributes to the facility of molding—favorably modifies the flow properties, etc. (2) It improves the property of shock resistance, yielding a strong tough molded part instead of a relatively fragile one, such as would be obtained if the resinoid were used without reinforcement. Truly, wood flour had much better be called a *reinforcing material* than a "filler".

Not Like Saw-dust

Physically, the wood flour acts as an absorbent for the resin. While the analogy is not perfect we might liken its function to that of a blotter absorbing ink. It serves as a carrying agent—a mass of fibrous material in which the liquid resinoid is dispersed.

The choice of wood is interesting, since all woods are not suited to provide wood flour. It will of course be realized that wood flour is a much more refined product than sawdust, although in the minds of the general public the two are frequently confused. Sawdust can be converted to wood flour by special grinding, the latter product being pulverulent in a somewhat strict sense of the word rather than granular or flocculent like sawdust. It will be appreciated that a much more homogeneous molded product results from the use of wood flour than would be possible were ordinary sawdust to be used.

Preference rests with such woods as pine and spruce. The choice of wood depends directly on its composition, chemical and physical. Wood contains, principally, cellulose and water; also minor amount of rosins, turpentine, oils, etc. Such wood as yellow pine is not adapted to provide the wood flour for plastics, because of the high percentage of rosin which it contains. Cedar on the other hand, is rejected because of its high content of aromatic oils. From the physical viewpoint hard woods are rejected in favor of softer varieties because they are lower in absorptive power.

Physical Characteristics

Texture, or more specifically the degree of fineness, is a property of especial importance. In order that the finished molded piece be of pleasing appearance, it is necessary that the wood flour fibres be entirely covered by a film of resinoid plus whatever pigment or dyes it embodies. A principal problem is to so adjust the fineness of the fibre that the flour incorporates itself unnoticeably in the molded piece, retaining, nevertheless, a texture which will produce a product characterized by a degree of strength and toughness which is more characteristic of fibers than of pulverulent materials.

In addition to all this there are various physical characteristics of the wood flour which must be considered. Cellulose

products, typified by the wood about us and the clothing which we wear, tend to absorb from the atmosphere quantities of moisture. Molded products are frequently intended for electrical service; hence the presence of moisture is to be avoided if the best characteristics of dielectric strength are to be secured. It is therefore necessary to obtain wood flour that contains a low percentage of moisture. Otherwise, one must extract the moisture by mechanical means.

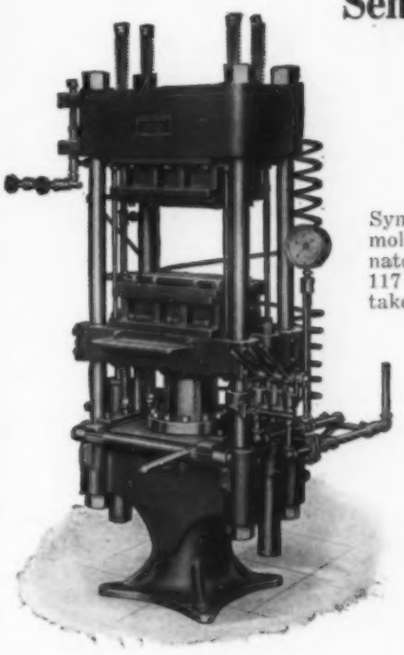
The color of wood flour—or the absence of it is likewise important. Preferably, it should be rather white. A slight darkness in shade may seriously deepen the color tone of the finished object.

Purity Essential

"Foreign matter" is another subject for attention. This may include a wide range of deleterious ingredients, such as ordinary organic or inorganic dirt, siliceous material—sometimes resulting from chipped balls in the grinding operations—metallic fragments, and scrap.

As in many industries, discussion of the subject of metallic impurities is not without a suggestion of humor. Carelessly dropped tobacco cans, paper clips, nails, tacks, etc., may enter at some early stage in the manufacture of wood flour, accidentally being "fed" to the machinery. To guard against even traces of these objects—which sometimes persist in final grinding operations—going through to the finished molding material, very careful separation and inspection is necessary. To this end mechanical sifting processes are successfully applied and magnetic separation is sometimes found profitable.

Prof. Henry Molinari, son of the illustrious Italian industrial chemist, and one of the research workers of the Italian Bakelite Co. recently spent some time in Chicago and in New Jersey visiting the American plants of the Bakelite Corp.



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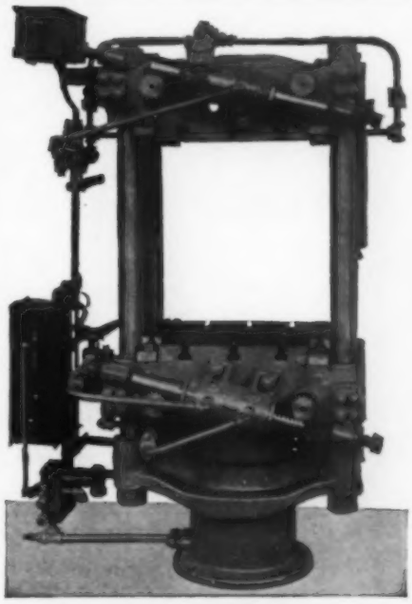

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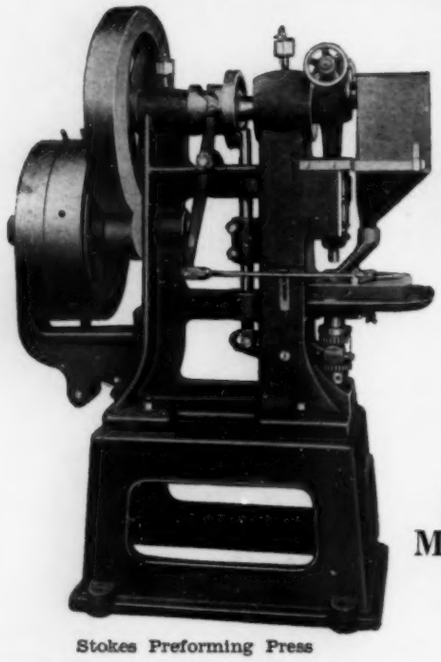

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Czechoslovakia

(*Continued from page 21*)

centrated in the vicinity of Gablonz and Teplitz. Gablonz is the center for the production of novelties and small wares frequently made entirely of plastics, while Teplitz is the center for the production of buttons and piano keys. Most of the consuming firms are relatively small and employ from 10 to 100 workmen. They are exporting about 90 per cent of their production and have been selling large quantities of finished goods in the United States.

American plastics are practically unknown in the Czechoslovak market. Manufacturers interviewed stated that the American products are too high in price and the delay incident to receiving goods after ordering also makes business difficult. It is believed, however, that the local market is susceptible of considerable development.

It is recommended that any sales to Czechoslovak firms be negotiated on the basis of cash on arrival at Hamburg. A demand for cash against documents in New York is inconvenient for the local manufacturers as it ties up their money too long.

German and Austrian manufacturers of plastics, however, are granting credit up to 90 days in Czechoslovakia. Such a practice, however, is not recommended for American firms in view of the unsatisfactory business situation at this time. It is believed that American firms will be successful if they base their quotations on the assumption that cash against documents will be the mode of payment and reduce their prices accordingly, rather than to quote the higher prices necessary where a 90 days credit is extended.

A comprehensive list of the manufacturers of plastics and fabricators consuming plastics may be obtained by accredited firms upon application to the Bureau of Foreign and Domestic Commerce, Washington, D. C.

Laminated Records

(*Continued from page 20*)

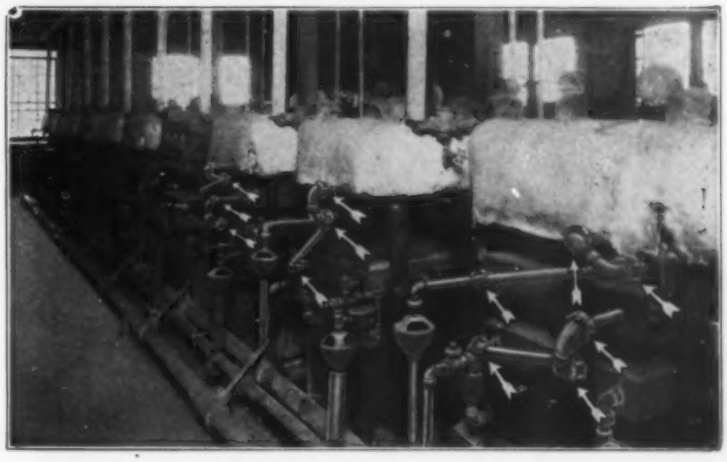
soft, absorbent and of a uniform thickness. These sheets, for example, should be in the neighbourhood of 17½" x 22½" and of a thickness that causes the sheets to weigh, say 27-30 lb. to the ream, but it is preferred to employ rolls of web 10½" or 12½" wide of a corresponding thickness.

The absorbent sheets may be cut to the desired shape in the first instance or the coated sheets or a laminated body made of such sheets may be stamped.

The sheets are coated or partially impregnated on each side with an adhesive or binding material so as to have an inner layer which is porous and substantially free from the binding material which should be a solution in an organic solvent (such as amyl acetate or alcohol benzine or a mixture of the two or amyl acetate and chloroform), of acetate.

Laminating

The coated sheets are allowed to dry or season for not less than 10 minutes until a considerable portion of the solvent of the binding material has evaporated. When suitably dried a number of the sheets according to the thickness it is desired the finished record should possess (for example, four or five may be employed to produce a record in the neighbourhood of 1/32nd of an inch thick) are taken and placed together one upon the top of the other. Assuming that a recording surface is required upon both sides of the disc, two seasoned sheets of recording surface material of about 5/1000ths of an inch in thickness are procured and placed one upon either side of the pile of coated sheets which form the inner body. The inner and outer sheets are registered and placed in a suitable press between the matrices of any suitable known kind for impressing a sound wave groove or track. These are heated by any appropriate heating means to a temperature up to 290°



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F. The pressure at which the printing or pressing of the record is performed makes it possible to print from a light shell matrix which need not be "backed" for strengthening purposes. A perfectly satisfactory record has been produced at an ultimate pressure so low as 250 lb. to the square inch. The solvent gases appear to be driven off as the pressure is gradually increased at or about and during the reduction of the temperature as aforesaid. For example, the press may be closed on the backs of the matrices at about 100 lb. to the square inch and after an interval of, say, five seconds the pressure is gradually but rapidly increased to approximately 250 lb. This action obviates any possibility of imprisoning any of the escaping vapours of the solvent so often occurring in the process of printing where a high pressure (usually uncontrollable) is necessary, such pressure frequently exceeding twelve thousand pounds to the square inch, a pressure that does not conduce to the serviceable life of a matrix even if strengthened and supported. The pressure and temperature are maintained for a period of, say, from one to five minutes (depending on the nature of the means for cooling the press) or for a sufficient duration to cause the solvents both in the binding material and the recording surface sheets to be driven off to an extent such that the surface material becomes hard and tough and rendered suitable for sound reproduction under the action of a stylus.

Cooling

It should be observed that it is not necessary to retain the matrices and the record in the press until they are quite cold. The matrices and the enclosed record may be removed together from the press (at a temperature almost too high to lift them by naked fingers) and then placed between two cold plates, the matrices and contained records being thus very quickly cooled. When cold, the

matrices can be easily and quickly separated from the surface of the pressed record by the act of applying a slight pressure by hand.

It is thought that the temperature to which the recording body, including the surface sheets, is subjected, which is such as to render plastic or almost liquefy the external element, fails to destroy the substance of the materials treated owing to escape of the solvent gasses through the porous strata provided by the laminated sheets of the inner body. The heat and comparatively low pressure treatment causes the record surfaces to bear a perfect replica of the matrices and a sound record is produced in which the surface is hardened and toughened to a degree that renders it more or less wear-proof while at the same time being perfectly smooth and free from scratching noise under the action of the stylus.

Using Blanks

According to a modification, it is possible to make record blanks according to the above process, in which case instead of pressing the record material between matrices, plain surface elements are employed for the pressing and heating process, the temperature being maintained well below that specified when it is desired to produce the finished sound record. The blanks thus formed may be stored for future use. A sound record may be impressed by pressure and heat treatment between matrices when the temperature would be raised to the neighbourhood of 290° F. In order satisfactorily to impress a sound record upon such blanks it is necessary in order to achieve the best results to reheat them at a comparatively low temperature in an atmosphere of the solvent vapours or otherwise subject them to hot vapours of the solvent.

Where it is required to produce a record with a sound impression upon one side only the laminated inner body may be

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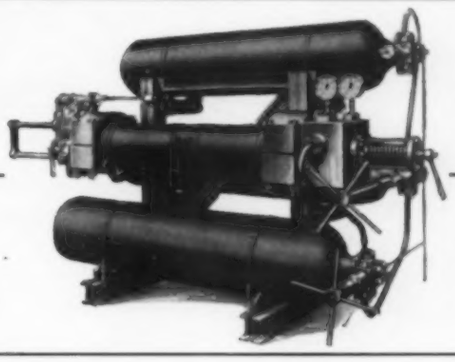

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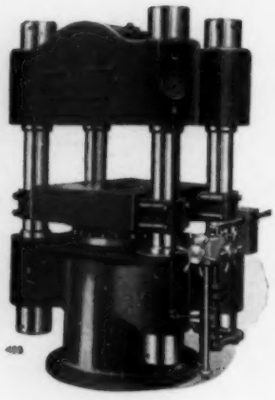

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provided with a recording surface sheet as described and with a backing of the same or inferior material of suitable tension which may be applied either in sheet form or after the pressing operation the backing may be coated or deposited by any suitable known process.

The sound records made according to this invention may be finished off by perforating the centre of the disc, trimming the peripheral edge and, if necessary, sealing such.

When employing surface sheets of, say, 3/1000ths of an inch in thickness the outer surface of the inner body is coated with a thin layer of rubber solution which may be applied by means of a brush or a wad of cotton wool or flannel or, if a very thin solution of rubber is employed, this may be run on to the outer surface of the inner body. The rubber solution may be such as is used for patching rubber tyres and if the marketed commodity is too thick it may be thinned with a few drops of benzine or gasoline.

Rubber Cushioning

The coating of rubber is allowed to dry until it becomes slightly "tacky." When the inner body with the rubber coating is in a suitable state the thin sheet of recording surface material which may be prepared as hereinbefore described is placed over the rubber coating and the matrix is applied according to the method detailed above. The heat and pressure by aid of the rubber cushion causes the material of the thin sheet to be driven into the groove of the matrix, the heat and pressure more or less vulcanizing the rubber operating as a cement between the inner body and the recording surface material. Thus the surface sheet, the rubber cushion and the inner body are amalgamated. In the process of heating and pressing the solvent of the rubber is expelled with the volatile gases from the surface material and the adhesive or binding material of the inner body.

When employing the rubber

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cushion it is found possible to dispense with the adhesive or binding material between the recording surface material and the adjacent surface of the porous inner body. When employing the surface material in the thinner sheet form indicated, the paper or material used for the inner body may be of a somewhat lighter nature, that is to say sheets of the weight of 27 lb. to the ream may be advantageously employed.

Mr. John Trickey, of the Miner Laboratories, of Chicago, Ill.; and one of the developers of the commercial production of furfural from oat-hulls, was recently the victim of a severe attack of angina pectoris that has confined him to the hospital for some time. At the time of going to press we understand that he is gradually recovering.

Recent Trade Marks

Prystal. La Societe Industrielle des Matieres Plastiques, Paris, France. Filed June 11, 1926. For handles for canes, parasols and umbrellas, etc. Claim use since Dec. 1925. Ser. No. 233086. Also Serial 1,233,-085, for Buckles, Buttons, etc.

Hekolith. Heko-Werke Chemische Fabrik A.-G. Berlin, Germany. Filed Mar. 22, 1927; Serial 246159. For Plastic Materials which may be treated and formed when heated and used in manufacturing prothesis, etc.

Celoid. Boston Varnish Co., Everett, Mass. Serial No. 249,499, filed May 25, 1927. For a lacquer.

Pyrohorn. Landers-Frary & Clark, New Britain, Conn. Serial No. 250,806, filed June 20, 1927. For meat carvers, etc.

New Firm With Unique Service

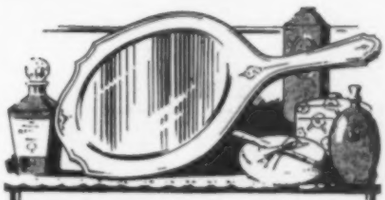
A NEW organization, Irving L. Goldberg, Inc. has been formed with offices at 271 Madison Ave. The president of the company is Irving L. Goldberg, formerly vice president of American Celutex Corporation.

The new firm will serve as sales representative for manufacturers of pyroxylin plastic sheets, rods and tubes and other related plastics. They also plan to distribute partly finished articles of varied plastic materials for further fabrication.

They will render a sales engineering service to manufacturers who contemplate the use of any plastic material. Handling all types of composition products they are able to select and recommend the plastic best suited to the purpose required.

This is a unique service in the industry and is a distinct departure from anything done before.

"WANTED: Sales Engineer—Man familiar with molding synthetic resin products—Experienced on mould design—press operation. The Celoron Co., Bridgeport, Pa."



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Pyroxylin Plastics in Egypt

Egypt imports considerable quantities of pyroxylin plastics, especially in the form of toys, toilet articles and ornaments; which find a ready sale to the natives.

In 1926 imports were 15,046 Egyptian pounds, as against 17,-588 in 1925. The trade is distributed as follows: From France, 6,571 Egyptian pounds; from Germany, 2,594; from Czechoslovakia, 2,072; from Japan 2,017; and from all other countries 1,792.

Japan's Trade in Pyroxylin

VICE Consul L. N. Green Yokohama, reports that during 1926 exports of raw and manufactured pyroxylin plastics from Yokohama, Japan, were valued at 2,924,313, of which $1,382,056 were shipped to the United States.

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Vol. 2 JANUARY, 1928 No. 1

Modern Cases for Modern Timepieces

In an effort to get something better and different for his clock cases, the modern clockmaker is turning to plastic materials, particularly molded phenol resinoid

"*ONE look is worth a thousand words*".—Confucius the divine sage of the ancient Chinese civilization.

"*Trifles make perfection, but perfection is no trifle.*"—Michael Angelo, the great Italian sculptor.

Both these epigrams may rightly be applied to the modern clock industry, in which the use of plastic materials is rapidly extending.

To increase the saleability of his wares, the modern clock maker is striving to improve his product and to fall in with today's all-pervading vogue of the brightly colorful.

How far the vogue of color has spread may be gauged from a recent article by Walter Rendell Storey in the *New York Times Magazine* for October 23, 1927.

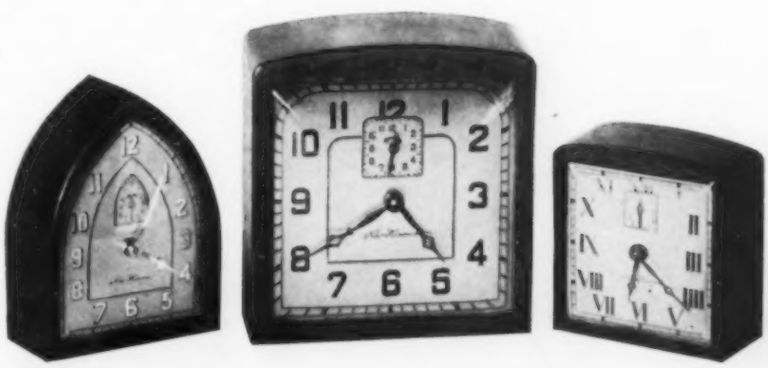
Says Mr. Storey:

"The vogue of color has at last reached clocks. Wall and shelf clocks . . are now enlivened with bright reds and blues and yellows . . for the ultra-modern interior. Solid colors in the new tones of today's decorative spectrum are discovered."

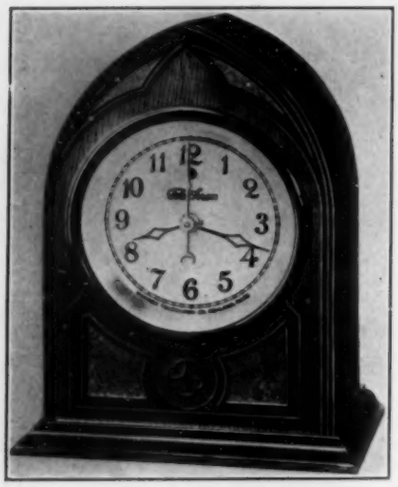
To lift its products out of the rut and to reawaken interest in clocks, the Gilbert Clock Company is marketing a line of "Color Clocks," taking "The rainbow has slipped indoors" as the keynote of its merchandising campaign. Further the vogue of the brightly colored clock has brought a new need for a clock in every room of the home to harmonize with and complete the decorative scheme.

Leaving the discussion of modern tendencies in the clock industry, what are the actual applications of the plastic materials in it? Consider the alarm clock, for instance. Metal for long seems to have monopolized this field, and for these reasons. The alarm must be cheap and able to withstand rough usage.

To avoid the appearance of cheapness without sacrificing the advantages of the mass production process, the New Haven Clock Company has recently marketed a line of alarm clocks with cases of molded phenol resinoid Twenty models of these "Artlarms" are offered.



A trio of New Haven Artlarms with molded phenol resinoid cases and unbreakable crystals. Bakelite and Durez are both being used.
(Courtesy N. W. Ayer & Co.)



The Cathedral model non-ticking Telechron clock operated from a light socket. The case is molded of Bakelite in walnut effect.
(Courtesy Warren Telechron Co.)

comprising a wide variety of colors, designs and faces. Such clocks do not tarnish nor does handling mar their cases. Moreover, the faithfulness with which the most minute details of the mold are reproduced in the finished cases permits of much greater refinement of design than with metal.

Unbreakable Crystals

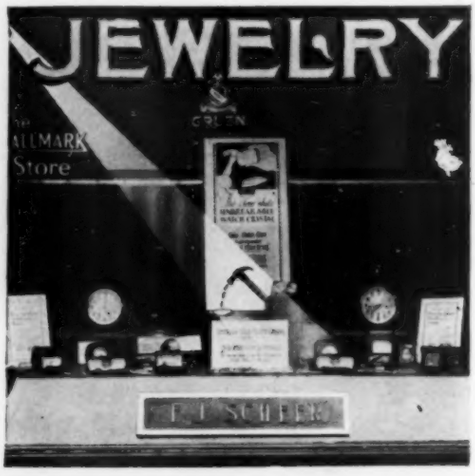
While the pyroxylin plastic boudoir clock has long formed a fitting accompaniment for today's beautiful toilet articles, the crystal made of these materials is coming into more extensive use. In harmony with their molded cases, the New Haven Artlarms are fitted with these unbreakable fronts, in this way raising the whole status of the cheap alarm clock.

In this connection, much is being made of the pyroxylin plastic crystal for the strap watch. To demontrate its superiority over the glass crystal, the Germanow-Simon Co. of Rochester, has an effective method. A window display features an ordinary heavy steel claw-hammer mounted on a camshaft. This hits the crystal of a high-grade watch rather forcibly more than once a second. In this way the watch crystal gets more knocks in a few minutes than in years of service. The resiliency of the material keeps the crystal away from the hands. No cement is necessary in fitting it, a permanent bevel keeping it in place.

Besides the alarm clock, essentially a hand-regulated instrument, the electric clock should provide a useful field for the application of molded phenol resinoid. One of the most recent developments here is the Telechron Clock, a time-piece regulated and run from the light socket.

The Cathedral model of these up-to-the-minute clocks has a case molded of the phenol resinoid Bakelite. Besides being endowed with much of the beauty of the walnut wood it simulates, it is entirely impervious to moisture and acid. Its high lustre is permanent, nor will its surface scratch or mark easily. The case is proof against cracking, blistering, or fading in sunlight. In addition the molded case costs less and is not liable to damage in transit.

Indicating the importance of the clock industry are some figures gathered in a survey conducted by the U. S. Department of Commerce in co-operation with the New England Council. It appears that the combined 1925 sales volume of firms reporting was $15,000,000, a figure which represents only the New England industry, constituting 45% of the total number of manufacturers of clocks and time recorders.



"Striking" testimony to the unbreakability of pyroxylin plastic watch crystals.
(Courtesy Jewelers' Circular, N. Y.)

Papier Maché Fire Buckets

Phenol Will Prolong Their Life

IN the danger buildings of the Royal Naval Cordite Factory papier maché buckets, are used as fire appliances. Experience has shown that the life of these buckets, as supplied by the trade, is very short indeed, seldom exceeding 2 to 3 weeks. At the suggestion of the Supt. an attempt was made some time ago to discover the cause of the deterioration with a view to finding means of preventing it.

When in use the buckets are kept full of water. An examination of a deteriorated bucket gave the impression that the water held in it had succeeded in penetrating the protective coating of paint, thereby dissolving the glue or paste used for holding together the paper or paper pulp used in making the bucket. A more careful examination of the damage, however, revealed that the cause of deterioration was more complicated, and that micro-organisms were probably taking part in the destruction. It was noticed, for instance, that the damaged buckets showed the presence of extensive myceliae growth and of numerous bacteria and that they often showed a marked odour of micro-biological growth.

To ascertain to what extent micro-organisms could be made responsible for the destruction, a number of buckets were made at the factory, in which the brown paper serving as raw material was molded into shape with a paste to which 1% phenol had been previously added to destroy the micro-organism normally present in the paste. In

(*Continued on page 52*)

Can Submarines Be Molded?

According to this invention, the answer is in the affirmative. The molded laminated submersible is claimed to be shock-proof, waterproof and heat insulating

THIS invention relates to a novel method of constructing the hulls of submarine and similar marine craft. The hull consists, briefly stated, of a number of plies of veneer or other similar material which are alternately arranged with plies of rubber material and intimately bonded by the latter, into a substantial integral structure. It is provided with a lining upon its interior of rubber material and a facing upon its exterior of similar material.

In order that the several plies constituting the hull may become intimately bonded and preferably united to one another as an integral structure, the plies, after suitable assemblage, are subjected to vulcanization.

In Explanation

In the accompanying drawings:

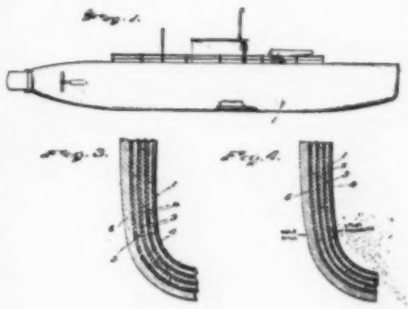
Figure 1 is a side elevation of a submarine constructed in accordance with this method;

Figure 2 is a perspective view illustrating the manner in which the component plies of the wall of the hull are arranged before assembly;

Figure 3 is a section illustrating the plies assembled and arranged within a mold for vulcanizing;

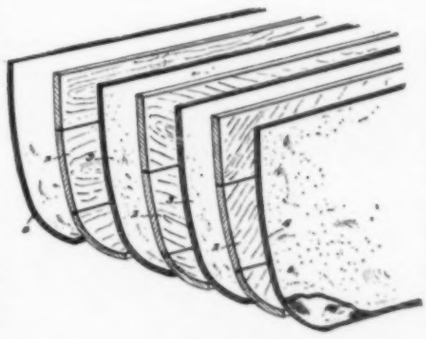
Figure 4 is a similar view illustrating the manner of vulcanization.

In the drawings, the hull of the submarine is indicated in general by the numeral and the wall of the hull is made up of an assemblage of plies intimately bonded together to form an integral and composite structure. Certain of the plies, indicated by 2, are of veneer or other similar material. These plies are alternated with other plies 3 of rubber, rubberized fabric, or other suitable rubber material.



The lower drawings illustrate the method of assembling the veneer and rubber plies in the mold.

A lining ply 4 of similar rubber material covers the inner surface of the hull, and a facing ply 5 likewise of similar rubber material, covers the exterior. This, in general, constitutes the structure of the wall of the hull. This is substantially integral, throughout, there being preferably no seams, joints, or places of division between the several component portions.



Veneer plies (2) alternate with rubber plies (3). The outside and inside layers are rubber.

In molding the hull, the plies above described after shaping are arranged as shown in Figure 2. The whole is then placed within a mold 6. It will be understood that the various plies may be assembled by laying them in place one upon another within the interior of the mold, the plies having been, as previously stated, shaped to the required contour.

The mold may be of any desired construction and as this does not enter into the present invention in a material aspect, the mold wall has been illustrated more or less diagrammatically. It is understood of course, that this wall is a rigid structure and conforms, on the inside, to the general shape of the entire hull of the submarine or other craft. When the various plies have been assembled, or the assemblage has been built up within the mold in the manner explained, the entire structure is preferably substantially hermetically sealed by closing all hatch and similar openings therein in a steam tight manner.

Vulcanizing the Structure

Steam under high pressure is then admitted into the assemblage and by reason of its expansive force, will exert great pressure against the wall of the mold as indicated in Figure 4.

During this step, the rubber content of the plies 3, 4, and 5 is vulcanized, and the entire number of plies are intimately and permanently bound together. The steam pressure is of course maintained until the heat has thoroughly vulcanized the plies, and after the process of vulcanization is complete, the hull, then in the form of an integral body, is removed from the mold ready to be equipped with hatches, the super-structure, and such other parts as are necessary.

(*Continued on page 53*)

Color and Light in Sign Making

An up-to-date example of the way the sign maker has utilized the colorful, unbreakable and non-inflammable features of a casein solid

NEW opportunities are offered to the sign-maker who recognizes the value of casein plastics in replacing glass in many branches of his work.

Signs go back to the first principles in advertising. The aim of the sign-makers is to catch the eye of the prospective customer, right at the point where the product or the service is for sale. Color and light have come to mean a great deal in his business. The use of electric lights, shining steadily or flashing at intervals behind letters of color, is now so widely accepted that the streets of our big cities by night, are as bright as day.

Electric lamps and colored glass have been the two outstanding requirements for these signs.

Color a Difficulty

In the designing of small interior changeable letter signs, it has been difficult to impart color with glass or by using electric lamps with colored glass caps. Attempts have been made to get color by inserting printed or colored sheets of paper behind glass; but this is only a feeble method and has never given the desired result. Others have used embossed paper letters and have slid pieces of colored gelatin behind these translucent letters in order to get color.

Drawbacks of Gelatin and Paper

Nor has this been very successful owing to the fact that the gelatin soon becomes so brittle that it falls to pieces. Furthermore, the gelatin dare not be disturbed and this type loses the very utility for which it was originally intended.

Again, the embossed paper letters become affected by the heat from without and within and "melt down" and lose their stiffness, with the result that the letters become light-shot easily. Add to these the fact that the embossed letters soil very easily and offer a ledge for the accumulation of dust, making this type of display very unsightly. Now from the advertising rather than the technical point of view: these embossed paper letters are done in white background with the letters in black.

An example of the Karolith changeable letter sign made by the Electric Display Corp., New York.

Lighting the embossed paper letters means actually lighting around the alphabetical letters which are printed black. Therefore, the letter itself recedes from the eye; the border around the letter coming to the eye. This in principle is wrong, since advertising is meant to convey the story the greatest distance and with the most attractiveness.

There has always been a demand for a colorful display free from these disadvantages. There has also been a great desire to get something into these displays which did not break like glass.

Breakage Losses Serious

Breakage has been a great handicap to the sign man. Aside from the loss from broken parts in his plant, he has lost a great deal in shipping.

The changeable letter sign depicted, is made of Karolith. The letters are made from sheet stock, lettered mechanically in such a way as to allow the beautiful translucent colors bordered with white to show through an opaque gold background. The slogan as well as the letters are made of Karolith.

Within the display is a flasher and from this an intermittent light passes through the letters, giving a flash of warm, deep colors. The interchangeability permits any user of this display to utilize a manifold number of signs all from one unit—as often and as readily as he wishes. Large advertisers have already manifested great interest in this unique and patented display.

Thus a casein plastic has again been applied to a new use and makes an unbreakable, non-inflammable, translucent and beautiful sign, always clean and always new.

The flasher sign depicted above is manufactured by Electric Display Corporation, 258-260 Fifth Avenue, New York.

The Age of Molding

III. Replacing metal and wood with molded phenol resinoid, it is possible to obtain the important sales factor of color, as well as resistance to heat, kerosene and rough handling

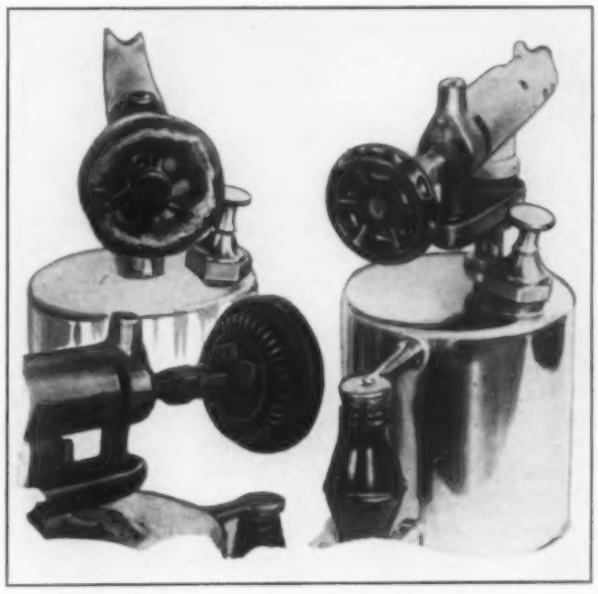
By A. Moses

IN reply to a tirade against mass production by a famous American novelist, a director of a leading American museum has said:

"A new conception of art in industry has been born in this country of unparalleled mechanical progress. Up to date, mass production has suffered the reproach that it lacks quality. But theory in this case, as in others, stands to be confounded by practice. For industrial leaders who have seen production brought to the point where it is tremendously efficient as to quantity are giving attention to quality and are proving this can be added to mechanical output. Machinery is capable of reproducing fine workmanship and multiplying tremendously at the same time."

This dictum is particularly to the point in discussing a process so intrinsically a quantity production proposition as molding.

* * * * *



A recent example of the incursion of the molded part into a field once monopolized by metal. The Bakelite valve wheel on the blow torch on the right is non-conducting and kerosene-proof. Such improvisations as those depicted on the left are now unnecessary.

IN the two previous articles under the same caption (May and June 1927), the writer confined his attention for the most part to instances of the successful replacement of metal by molded parts. Examples were drawn from widely different fields to illustrate the manifold advantages of the molding process as applied to plastic materials, the phenol resinoids, more particularly.

Successful quantity production, so essential a feature of modern manufacturing methods, is greatly facilitated by the molding process, and not without good reason. Molding resinoid is essentially a unit process—one operation achieves the results of many. Not only is time saved, but—very important—space also.

True, modern lacquers applied mechanically, are conducive to economy in production, but a lasting lustrous surface results from pressing in a highly polished mold.

Solid Colors Possible

Even the lacquer-protected metal surface is liable to deterioration and subsequent tarnishing, an event impossible in the life of the molded phenol resinoid. Apart from lacquer and enamel, the latter difficult to apply and short-lived in face of rough usage, a solid colored effect is difficult to achieve in metal. Plastic materials make such effects easy to attain.

It would appear that even the property of successfully resisting wear and tear is no longer monopolized by metal. For, as came to light in a recent article on the subject (MOLDED PRODUCTS, Dec., 690) the number of cases where molded phenol resinoid has outworn metal is growing

Consider now some recent examples of the use of the molded part in place of that made of some other material.

Handles are important components from many points of view. On their material and construction may depend the comfort and safety of the operation of a piece of apparatus For example a very striking case of this is the valve on certain blow torches made by the Huffman Mfg. Co., Dayton, O. By conduction through the valve stem, this wheel is liable to become so unbearably hot, that operators have been obliged to

(*Continued on page 48*)

Another Socket With Molded Shell

To avoid the possible formation of weak places where inserts enter, this socket is so arranged that the metal inserts are held without embedding

ONE of the difficulties arising in the manufacture of two-way sockets with molded casings is the liability of the casing to crack, particularly at points close to the metallic parts embedded within the casing during molding.

The invention under review is directed toward the provision of a socket which overcomes this difficulty, and which tends to reduce the percentage of breakages during manufacture.

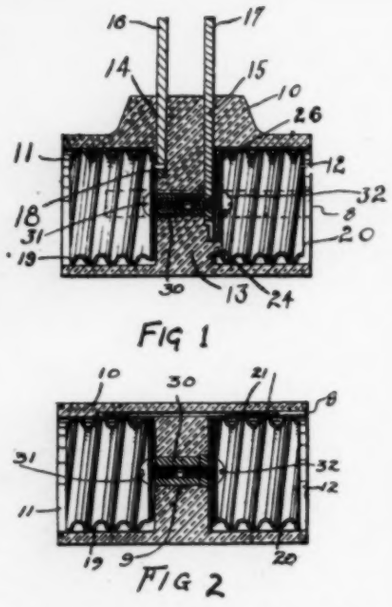
In the accompanying drawings, Fig. 1 represents a median sectional view along the length of the socket, and through the connecting pieces 16 and 17. Fig. 2 is a median sectional view at right angles to the first.

Structural Details

As shown, the molded casing 10 has sockets 11 and 12 separated by a wall 13 which is part of the casing. The latter also has passageways 14 and 15 which lead outwardly from the openings 11 and 12 respectively, and has a passageway 9 which extends through the wall 13 and connects between the sockets 11 and 12.

Current may be brought into the casing through contact members 16 and 17 shown as extending into the passageways 14 and 15 respectively and as projecting beyond the outer surface of the casing. As indicated, a part of the member 16 is exposed within the socket 11 and is electrically connected by a member 18 to a threaded shell or socket 19. The socket preferably sets closely within the pocket.

A socket 20 similarly formed to the socket 19 is disposed within the pocket 12 but is electrically insulated from the plate 17. The two socket members, however, are electrically connected by a plate 21 disposed



Two sectional views through the two-way socket with metal inserts held with embedding.

within the passageway 16. This plate has upturned ends indicated as 22 and 23 slightly yieldable; so that an effective electrical connection can be made between the socket members whenever the plate is embedded within the passageway 16.

Inserting the Contacts

The plate 21 may be placed in position by inserting it endwise into the passageway 8 through the pocket opening 12 before the socket member 20 is inserted within the casing.

The ends of the plate 21 engage the outer surfaces of the socket members and are prevented from moving out of the casing owing to the fact that the yieldable ends of the plate 21 engage the corrugated outer surface of the socket members.

The socket member 19 is prevented from rotating within the casing by the connection 18 between the member and the blade 16. Accordingly to prevent the socket member 20 from rotating within the casing, the latter has a lug 24 which projects into an opening 25 within the flange portion 26 of the member 20.

As the contact 17 is oppositely charged to 16, the plate 17 must be electrically insulated from the socket members 19 and 20. To this end, a sleeve 30 is embedded within the wall 13 so that the axis of the sleeve is in line with the axis of the socket members 19 and 20 respectively. The interior of the sleeve is threaded to receive contact screws 31 and 32, the heads of which extend into the respective socket members and are electrically insulated from them. The screw heads therefore form one terminal while the socket members form another terminal for each outlet.

U. S. Patent 1,650,869 covers this socket issued to Isaac F. Giles on Nov. 29, 1927 and assigned to Ileite Electric Mfg. Corporation.

A rather different three-way plug with a two-piece molded shell in which the metal parts were held without embedding was described in the December issue (page 700).

An interesting example of the molder's art, the "Foursome," a four way outlet suitable for making attachments on the table, will be described in an early issue.

In the article "Resinoid Bowling Balls" (November, page 630) the caption to the illustration should read:
"A trio of cement-covered bowling balls molded of the resinoid Durez".

An expert will write on

The Design of Metal Inserts

in the February issue

THESE ARE SCRANTON PARTS

MADE IN THE LARGEST MOULDING PLANT IN THE WORLD

AND MADE AS ONLY SCRANTON CAN MAKE THEM

WHAT ARE YOUR REQUIREMENTS

The Scranton Button Co.

SCRANTON, PA.

Western Representative, Gordon D. Wilson
645 Washington Boul., Chicago, Ill.

New York Office, 50 Union Square
Arthur Wiseburn, Manager

Ohio Representative, J. E. Black & Co.
The 4900 Euclid Bldg., Cleveland, Ohio

Beautifying the Switchplate

Besides securing freedom from short circuit dangers, these molded switchplates permit of colors and effects to harmonize with the vivid hues now so modish

In an article "Modern Electrical Fittings are Molded", the writer detailed the reasons for the increasing use of molded phenol resinoid in place of metal wiring devices. Points of superiority brought out were—their freedom from short-circuiting with its attendant dangers; their resistance to corrosion and to the deleterious effects of humid, salt- and fume-laden air; their pleasing polish, —permanent because imparted in the mold itself and not dependent on the endurance of a lacquer or varnish film.

Achieving Color Effects

There is another advantage, however, of particular importance for switchplates—the possibility of easily achieving permanent color effects. A cursory examination of recent numbers of this publication should offer evidence convincing enough of the widespread vogue of vivid color In the May issue, for instance, in an editorial entitled "Colorful Trends", the writer outlined the role of plastic materials in these developments of beauty and bright colors, tendencies intimately bound up with the beauty of the home scene.

In designing homes being built today attention is paid to every single detail of the decorative scheme. Even the appointments once thought commonplace are now called upon to add their touch of beauty to the appearance of the room.

Take, for example, the wall switch-plate. One now has the opportunity to select a wide variety of color effects that were unheard of before in fixtures of this kind. If the plate is desired to match the woodwork of a room, there is one giving the effect of rich mahogany or walnut, exactly duplicating the natural grain of these beautiful woods. If, on the other hand, the color scheme of the room is white, there is a switch-plate in creamy ivory.

Pearl Plates

For something strikingly different, why not an exquisite pearl plate in blue, rose, green, or white? These new effects can be had for all the standard push-button and toggle plates, as well as door-plug plates for lamps and other accessory attachments.

When swinging doors are used, a door panel in any of these colors can be had to match the switchplate, thus giving a uniform note to the room. A distinctive feature of these plates is their resiliency, a property which enables them to take the contour of the walls.

Hotel Fixtures

In addition to the use of these fixtures in the home they are proving very popular for use in hotels, clubs, apartment houses and office buildings The new Hotel Manger, which is said to be one of New York's finest hostelries, is equipped throughout with these new fixtures, selected to harmonize with the rooms. Another hotel similarlarly fitted is the President Hotel, Atlantic City, N. J.

These colorful electrical fittings are made of Dumold by the Robinson Products Co. of Philadelphia, Pa.

Switch-plates of this type are produced in a variety of color effects. A blue pearl plate was photographed for the illustration, which does not do justice to the original.

PLASTIC MOLDING

Bakelite Motion Picture Camera Box, moulded by Shaw

IF YOUR JOB is one that requires expert craftsmanship, if your molded parts must be perfectly made and finished to the highest degree of accuracy, it will pay you to consult Shaw.

In other words, if your first consideration is to procure quality molding you need a quality molder.

Producers of the finest in moulded parts for thirty-five years.

SHAW INSULATOR CO.

IRVINGTON, NEW JERSEY

Established SHAW 1892

A Sales Factor in Toilet Goods

A prominent toilet goods' concern is utilizing a molded boudoir jar to promote the sale of a beauty product

IN an article dealing with the use of plastic materials for toilet goods, (MOLDED PRODUCTS, September 1927, page 483), attention was directed to recent developments in this field. In particular, stress was laid on the elevation of the container to an *objet de vertu*, worthy of the collector's zeal. Another point made was the value of such containers in providing an incentive to the purchase of their contents. One instance of this is now being developed by the up-to-date house of Terri, Inc., makers of the molded compact.

To push the sale of a brand of face powder, this concern is presenting purchasers with a powder jar molded of Bakelite. In this way they hope to appeal to the public's craving for the unusual. At present the jar comes only in black but its production in colors is expected before long.

Pyroxylin plastic is the material now in general use for dressing table sets, each with its powder jar. The casein solids too, find wide application for compacts, boudoir boxes and manicure handles. Yet a phenol resinoid was chosen in this instance. Why?

Inquiry revealed that while

A powder jar molded in black Bakelite, (Courtesy Terri Inc.)

largely actuated by the desire for something unusual, the advantages of a molded article also contributed in making the choice. No machining is necessary. Apart from the metal knob, both jar and lid are completed in the molding operation. Absolute uniformity is attained, so that any lid will fit any jar.

How about metal? Successfully to compete with the molded jar, stamping is the only process to come up for consideration. But the latter process applied to quantity production cannot bring that refinement of detail in design so easily achieved in molding with phenol resinoid materials.

Lasting Beauty

Although lacquered brass is fairly immune from deterioration through tarnishing, the lacquer wears off in time and exposes the metal. Phenol resinoid, on the contrary, does not suffer from this drawback and what is more, the polish on the mold cavities is imparted to the product. Further the glossy surface is permanent, and does not become shabby through continual handling, nor dent through rough usage.

Again, the question of color crops up. Without enamelling or lacquering, color on metal is

(*Continued on page 53*)

MOULDERS OF PLASTICS & BUILDERS OF MOULDS

KUHN & JACOB
MACHINE & TOOL CO.
TRENTON ~ ~ ~ ~ N.J.

One of the many fine pieces we turn out.

A Special Message from The Siemon Family

The Siemon Company
Bridgeport, Conn.

The Specialty Insulation Mfg. Co.
Hoosick Falls, N. Y.

Duranoid Manufacturing Co.
Hoosick Falls, N. Y.

The Watertown Manufacturing Co.
Watertown, Conn.

The Colasta Company
Hoosick Falls, N. Y.

The American Composition Co.
Watertown, Conn.

You, a present user of moulded parts, or a prospective user of these parts are not interested in illustrations of the thousands of parts that we make for hundreds of various uses. You are only interested in securing prices and service from a dependable source of supply.

Our organization, twenty-five years old, is complete in being able not only to supply the practical brains for solving your moulding problems but is also complete in being enabled to supply you with all of the moulding material, and also mechanical equipment required from our own plants and under our own supervision.

Expensive and extensive laboratories not backed by practical compounding and moulding experience mean nothing. A manufacturer who must depend on outside sources for the supplying of his customers' needs for moulding material and mechanical equipment, you will admit, is certainly at a disadvantage insofar as being in a position to guarantee quality, price and service when compared with a competitor who has plants completely equipped to supply everything without outside help.

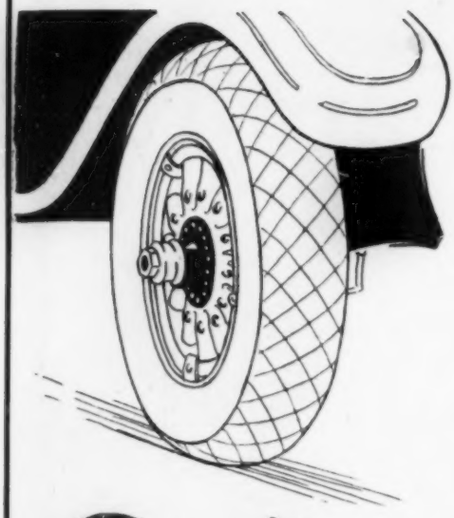
SUMMARY

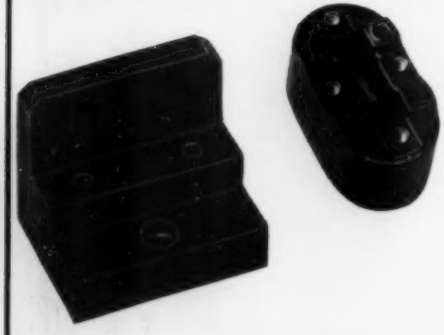
WE HAVE THE PRACTICAL MOLDING BRAINS

WE ARE COMPLETELY EQUIPPED

OUR GUARANTEE IS YOUR INSURANCE FOR SERVICE QUALITY AND PRICE

As important as the tire – is the molded part...





In few industries are progress and advancement so rapid and obvious as in the automotive. New ideas, new applications, new accomplishments are being achieved in rapid succession.

Keeping step with the times we announce the greatest development yet reached in the art of cold molding. Beautiful pieces perfectly made with all the advantages of this type of work may now be had in varied colors and mottled effects.

An inquiry from you will bring full information.

Connecticut Molded Products Corporation

Meriden, Connecticut

Age of Molding

(*Continued from page 41*)

protect their hands by improvised insulation of some kind.

By using a wheel molded of the phenol resinoid Bakelite, such makeshifts become unnecessary. The low thermal conductivity of the material means a cool wheel. Moreover, as ten such handles can be molded at a time, they are economical to manufacture. Other points gained are improved design, lighter weight and better appearance, the latter an important sales factor.

Wood Displaced

The Multipost Stamp Machine furnishes an interesting instance of the displacement of wooden handle by its molded counterpart. It took several operations to shape and finish such wooden handles. Providing the square hole to fit the square plunger, was also a difficulty. Two methods were tried and both proved unsatisfactory. Now by molding the part of Bakelite, five handles can be formed at a time, complete with "operating instructions" molded in relief and easily legible.

Color Promotes Sales

Follows an apt example of the importance of the colored handle for increased business in the knife industry.

A New England cutlery concern had been getting along comfortably for a century. Among their hundred-odd employees were men who had been with them thirty and forty years. It was a family type of organization, amidst pleasant rural surroundings; and the well-made, black-handled knives which they turned out had been in good demand and in good repute.

One customer took a third of the output. In the course of time, said customer went the way of all mortals, and the problem loomed of how to make up that one-third loss of business. The first and obvious

course was or seemed to be, the laying off of men. But that was hard to do. The anxiety not to impair the working force led to the decision to go out and take a good look at the market and see if knives were still merely knives or had become something else.

The Discovery of Color.

They explored the household furnishings sections of department stores, they looked at the window displays of hardware shops, and they became acquainted with the modern teashops and their ornamentation, as well as with the new decorative schemes of kitchen cabinets and apartment house domestic equipment.

This little journey to the market showed that knives were no longer merely knives but part of an ornamental set-up demanded by modern consumers, and that black-handled cutlery simply did not fit into the picture.

The Blue Handle Wins

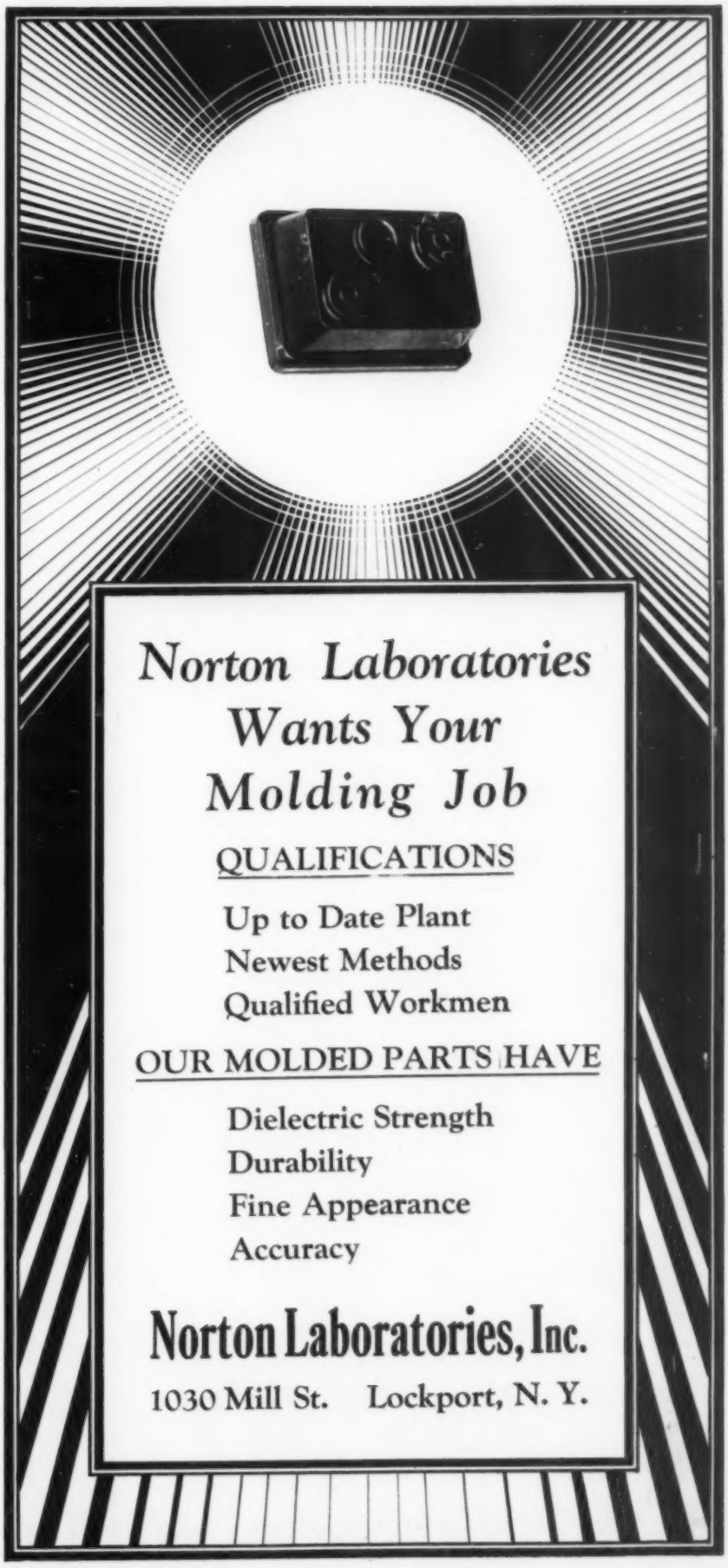
When they changed the handle colors from black to blue, they did fit right into the picture and the resulting increase in business more than made up for their lost customer. They kept their men and their market.

* * *

The fourth article in this series will deal with certain rather unusual examples of the ways in which the molded part is replacing that made of non-plastic material and by other methods.

The Display Window

NEW color effects in window display are being achieved by the use of pearl Pyralin, a pyroxylin plastic sheeting. The floor of the display window, covered with this transparent material over colored tissue paper, makes an effective background for an exhibit. Interior show-cases take very well to the new treatment, as the material has an attractive iridescense under artificial lighting. It is appropriate for leather goods, hosiery or any merchandise not too ornate in character.



MOLDING

BAKELITE
Twenty Years Experience
Moulders since 1908

Service for Every Need

NOVELTIES - MECHANICAL AND ELECTRICAL PARTS

The Story of Timing

A phenol resinoid cam gear with its attendant steel gears.

The first part of this story detailed the advantages of laminated phenol resinoid over metal, rawhide, cotton and fiber for gear blanks and the difficulties surmounted. In the final portion, the properties of these gears are described together with certain details of their manufacture.

• • •

IT is a material that can be machined readily, is self-supporting and is held together by its own inherent properties. The other grades are made in much the same manner except that linen, paper or the like, is substituted for the canvas.

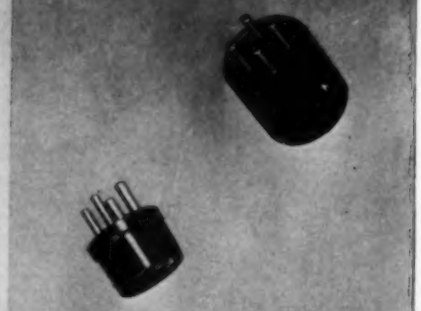
In manufacturing the flexible-web gear, individual forming dies or molds are made for each size or type of blank to be produced. Discs and rings of impregnated canvas are then assembled in the mold. The loaded molds are then placed in hydraulic presses and heat and pressure are applied. One important advantage, from a manufacturing standpoint, in the production of this type of gear-blank is the ability to apply the heat more uniformly than in the case of the large sheets, due to the relatively small size of the individual molds.

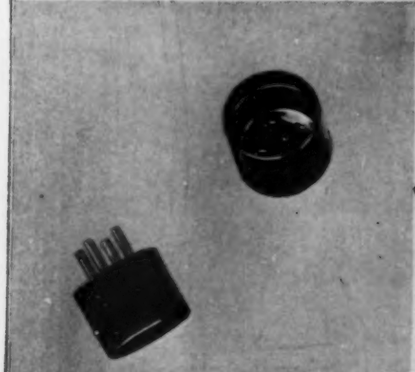
Where the design of the blank calls for a metal center or bushing to facilitate the keying of

TUBE BASES OF EVERY SIZE COLOR AND TYPE

Perfection of the smallest details have made these tube bases the standard of comparison wherever such parts are used.

The same exactness is featured in every part we mold.





MODERN MOLDED PRODUCTS CO. INC

BLOUNT AND ELM STS.

PROVIDENCE, R.I.

*E. F. Behning, Journal Institute Automotive Engineers, Jan. 1927.

the Silent Gear

the gear on the shaft, the metal center is molded in place. This center is made with a coarse diamond knurl and no rivets or other fastening devices are necessary. In fact, the center is held so securely in the blank that a force of 10,000 lb. per sq. in. is necessary to push it out on an arbor press. This method of inserting the center is much superior to the former practice of pressing in the bushing and holding it in place by rivets. Rivets come loose and, in addition, in the former practice the press-fit in some cases set up internal stresses in the blank which caused distortion. When the center is molded-in, no internal stresses are set up.

Physical Properties

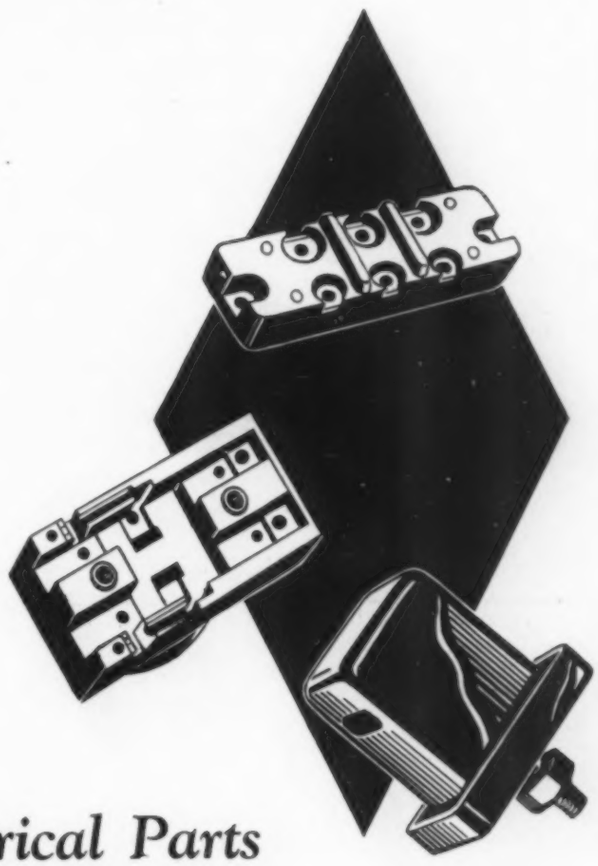
Regarding the physical properties of the product, its specific gravity is 1.35, and it has a Brinell hardness on the sides or natural face of 45.0 and on the sawed or turned face of 36.4, these values being obtained by applying standard formulas to the measurement of the impression made by a 10-mm. steel-ball held under a pressure of 500 kg. for 15 sec.

Its tensile strength is 8000 to 10,000 lb. per sq. in.; its compressive strength is 40,000 lb. per sq. in. when its laminae are horizontal and 25,000 lb. per sq. in. when its laminae are vertical; and its transverse strength is approximately 23,000 lb. per sq. in. with laminae horizontal and 25,000 lb. per sq. in. with laminae vertical.

The coefficient of expansion is 0.000017 per deg. fahr., and the modulus of elasticity, or the load per square inch divided by the elongation per inch, is approximately 1,555,000 lb. per sq. in., this being an average of 10 readings.

Its impact strength was determined by an Olsen testing-machine, using a 60-lb. pendu-

Auburn

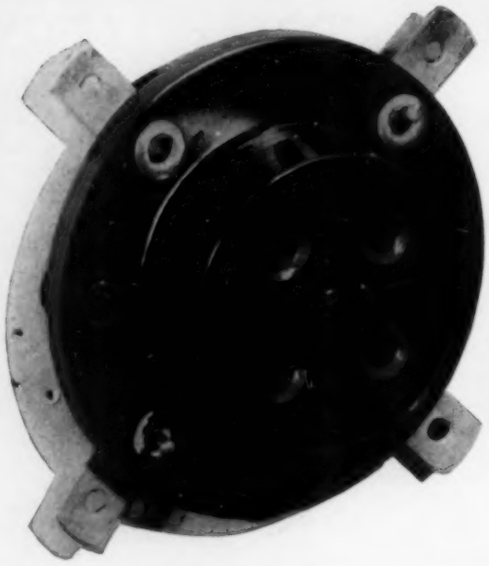


Electrical Parts
AUBURN MOLDED

—as convincing in actual performance as they are in appearance—

A request for information will receive careful and immediate attention.

Auburn Button Works, Inc.
AUBURN, N. Y.



Radio Tube Socket

A remarkable example of Bakelite molding with metal inserts.

Molds made and production started at very short notice.

SAMPLE AND PRICE ON REQUEST

THE RECTO MANUFACTURING CO.

23 W. Third St. Cincinnati, Ohio

Molders of Bakelite

BAKELITE

Molded Parts

QUALITY QUANTITY DEPENDABILITY

Boonton Molding Co.

324 Myrtle Avenue

Boonton, New Jersey

CUSTOM MOLDERS

lum and measuring the loss in foot-pounds. In making this test a sample 1 in. square in section was broken by a blow delivered 20 mm. from the point of support. A blow parallel to the plane of laminations gives values of 35 to 40-ft.-lb., and a blow at right angles to the plane of laminations gives values of 47 to 50 ft.-lb.

Our investigation has indicated that impact strength is a more important measure of quality than tensile strength or compressive strength.

Gears made of our material can be machined with the same equipment that is ordinarily used in machining metal gears.

Papier Maché Buckets

(*Continued from page 38*)

addition, a few control buckets were prepared, using a paste to which no antiseptic had been added. Both lots of buckets were made by the same worker under identical conditions and using the same kind of brown paper as raw material, and after molding were cleaned and painted under identical conditions.

When dry both series were filled with water and left at room temperature under conditions corresponding to those under which papier maché buckets are kept in the danger buildings.

The difference in the behavior of the two series of buckets is very marked indeed. While those to which no antiseptic had been added invariably became soft and collapsed after two or three months, those made with a paste containing phenol have remained sound for more than 18 months, in spite of the fact that the interior coat of paint has worn rather thin.

"Note on the examination of decayed Papier Mache Fire Buckets" contributed by H. C. Thaysen, Ph. D. and H. T. Bunker, M. D. to a recent number of Chemistry and Industry (London) was the source of the above information.

Molded Submarine

(*Continued from page 39*)

In assembling the various plies comprising the wall of the hull, care is taken to avoid any seams or other discontinuities, the plies being so arranged that where the edges of two veneer plies, for example, are located, the joints will be overlapped by an unbroken ply, on each face, of the rubber material constituting either the bonding plies or the facing or lining plies. Also care is taken so to arrange the veneer plies that in adjacent layers they will break joint, thus providing against any weak places in the wall of the hull.

The structure is one possessing a desirable degree of resiliency, flexibility, and yieldability, is water-proof, capable of absorbing shocks and impacts and of withstanding severe compressive forces and strains, and heat and sound insulating.

Rubwood, Inc., is the organization to which has been assigned the invention. This is U. S. Patent 1,638,818 of Aug. 16, 1927, applied for as long ago as 1923 by Harry N. Atwood.

Promoting Sales

(*Continued from page 46*)

difficult to obtain. Even with surfaces processed in this way, chipping and wearing mar the appearance. With resinoid, a wide range of permanent colors and effects is readily secured.

Over glass the jet-like molded jar has the advantage of comparative unbreakability. There is no possible danger from chipped edges, nor can glass splinters fall into milady's powder with what direful results only the reader can imagine.

The knob of oxidised brass is in handsome contrast with the black of the jar and lid. It is not embedded but rivetted in afterwards. Four jars and four lids are molded together, and the molders are Northern Industrial Chemical Co.

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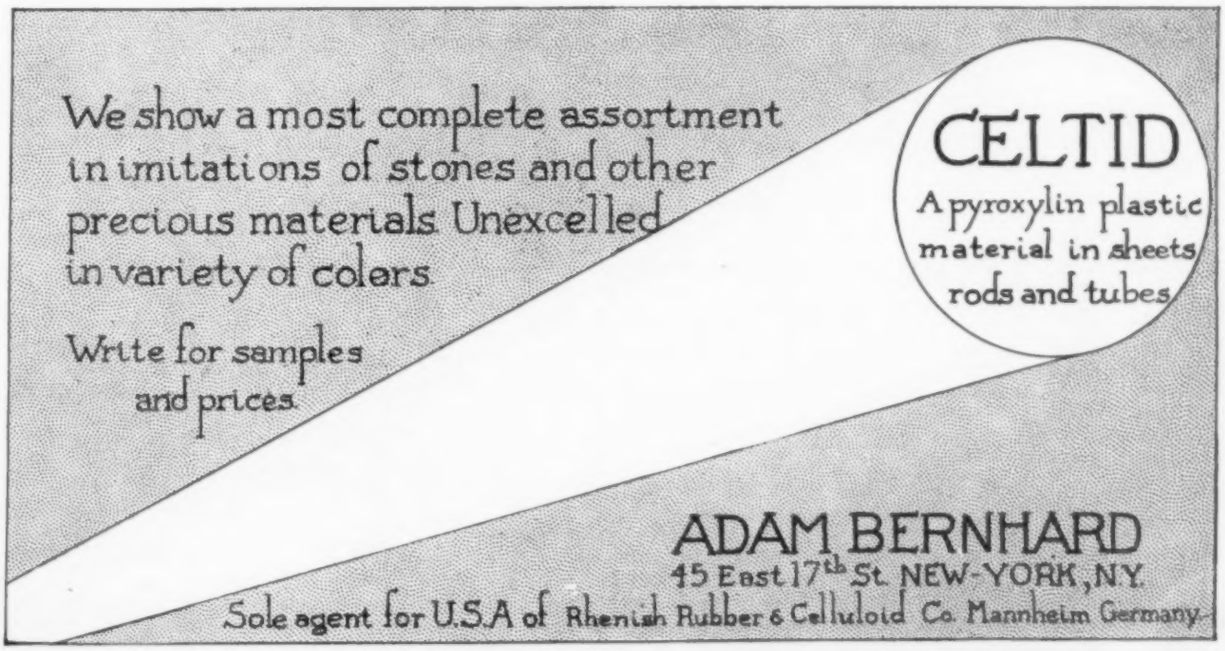
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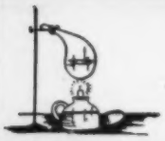

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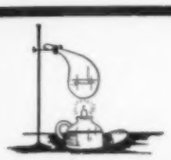

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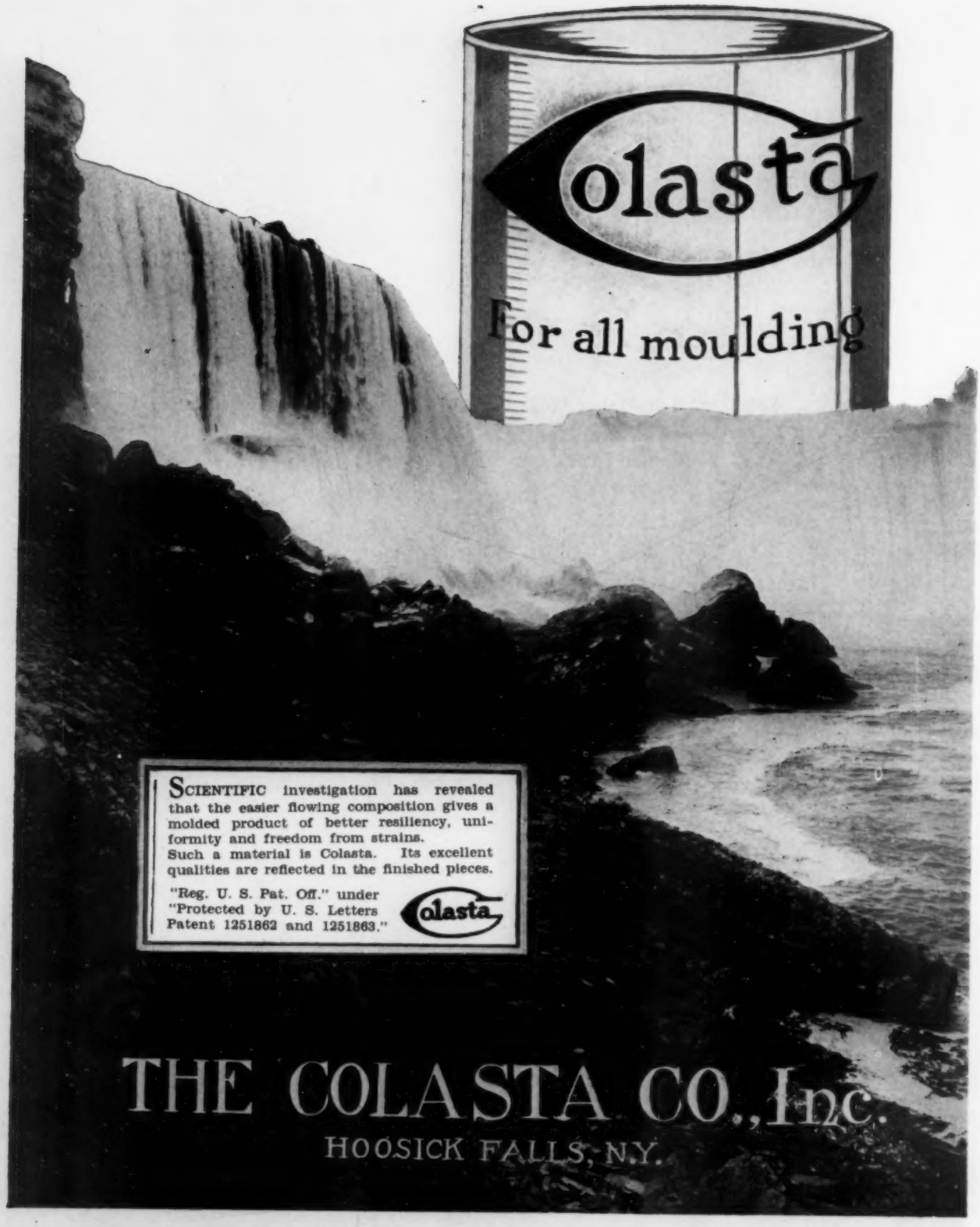
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